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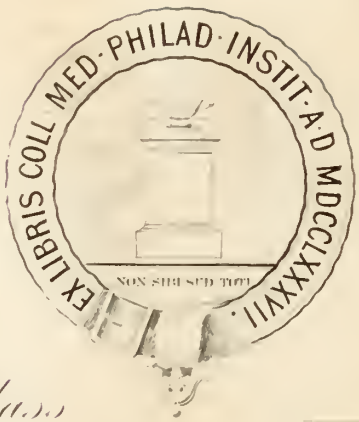

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TRANSACTIONS

OF THE

COLLEGE OF PHYSICIANS

OF

PHILADELPHIA.

THIRD SERIES.

VOLUME THE THIRTEENTH.

PHILADELPHIA:
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1891.

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The present volume of Transactions contains the papers read before the College from January, 1891, to December, 1891, inclusive.

The Committee of Publication thinks it proper to say that the College holds itself in no way responsible for the statements, reasonings, or opinions set forth in the various papers published in its Transactions.

DORNAN, PRINTER.

COLLEGE OF PHYSICIANS OF PHILADELPHIA.

1891.

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LIST

OF THE

PRESIDENTS OF THE COLLEGE FROM THE TIME OF ITS INSTITUTION.

ELECTED

1787. JOHN REDMAN, M.D.

1805. WILLIAM SHIPPEN, M.D.

1809. ADAM KUHN, M.D.

1818. THOMAS PARKE, M.D.

1835. THOMAS C. JAMES, M.D.

1835. THOMAS T. HEWSON, M.D.

1848. GEORGE B. WOOD, M.D., LL.D.

1879. W. S. W. RUSCHENBERGER, M.D.

1883. ALFRED STILLÉ, M.D., LL.D.

1884. SAMUEL LEWIS, M.D.

1884. J. M. Da COSTA, M.D., LL.D.

1886. S. WEIR MITCHELL, M.D., LL.D.

1889. D. HAYES AGNEW, M.D., LL.D.

FELLOWS

OF THE

COLLEGE OF PHYSICIANS OF PHILADELPHIA.

DECEMBER, 1891.

[Non-resident Fellows are marked *.]

ELECTED

1883. Abbot, Griffith E., Ph.D., M.D.

1870. Adler, John M., M.D.

1859. Agnew, D. Hayes, M.D., LL.D., Professor (Emeritus) of Surgery in the University of Pennsylvania; Consulting Surgeon to the Orthopædic, the Maternity, and St. Christopher's Hospitals.

1876. Alison, Robert H., M.D.

1867. Allen, Harrison, M.D., Professor of Zoölogy and Comparative Anatomy in the University of Pennsylvania.

1873. Allis, Oscar H., M.D., Clinical Lecturer on Orthopædic Surgery in Jefferson Medical College and Surgeon to the Hospital of the same; Surgeon to the Presbyterian Hospital.

1888. Anders, James M., M.D., Professor of Hygiene and Clinical Diseases of Children in the Medico-Chirurgical College, Philadelphia; Physician to the Philadelphia Hospital.

1869. Andrews, T. Hollingsworth, M.D., Consulting Surgeon to the Hospital of the Good Shepherd, Radnor; Medical Director of the Bureaus of Police and Fire of the Department of Public Safety.

ELECTED

*1882. Ashbridge, Richard, M.D., Assistant Surgeon U.S.Navy.

1863. Ashhurst, John, Jr., M.D., Professor of Surgery in the University of Pennsylvania; Surgeon to the Pennsylvania and the Children's Hospitals; Consulting Surgeon to St. Christopher's and the Woman's Hospitals, and to the Hospital of the Good Shepherd, Radnor.

1865. Ashhurst, Samuel, M.D., Surgeon to the Children's Hospital.

1857. Atlee, Walter F., M.D., Consulting Physician and Surgeon to St. Luke's Hospital, Bethlehem.

1852. Bache, Thomas Hewson, M.D.

1883. Baer, Benjamin F., M.D., Professor of Gynecology in the Philadelphia Polyclinic.

1879. Baker, Washington H., M.D., Obstetrician to the Maternity Hospital.

1876. Baldwin, Louis K., M.D., Examining Physician to the Hospital of the Good Shepherd, Radnor.

1889. Baldy, John M., M.D., Professor of Gynecology in the Philadelphia Polyclinic; Gynecologist to St. Agnes Hospital; Surgeon to Gynecean Hospital.

1880. Bartholow, Roberts, M.D., Professor (Emeritus) of Materia Medica, General Therapeutics, and Hygiene in Jefferson Medical College.

1883. Baum, Charles, M.D., A.M., Ph.D.

1873. Baxter, H. F., M.D.

1883. Beates, Henry, M.D.

1860. Benner, Henry D., M.D.

1874. Bennett, W. H., M.D., Physician to St. Christopher's Hospital for Children, and to Children's Seashore House, Atlantic City.

1884. Biddle, Alexander W., M.D.

1884. Biddle, Thomas, M.D.

*1866. Black, J. J., M.D.

*1867. Boardman, Charles H., M.D.

1859. Boker, Charles S., M.D., Surgeon to St. Joseph's Hospital.

ELECTED

1891. Boyd, George M., M.D., Physician to the Lying-in Charity; Surgeon to the Out-door Department Episcopal Hospital; Assistant Surgeon to the Kensington Hospital for Women.

1884. Bradford, Thomas Hewson, M.D., Physician to the Dispensary of the Children's Hospital and to the Gynecological Departments of the Pennsylvania and the Howard Hospitals.

1856. Brinton, John H., M.D., Professor of the Practice of Surgery and of Clinical Surgery in Jefferson Medical College; Surgeon to St. Joseph's Hospital; Consulting Surgeon to the Southwestern Hospital of Philadelphia.

1891. Brinton, Lewis, M.D.

1887. Brubaker, Albert P., M.D., Professor of Physiology and General Pathology in the Pennsylvania College of Dental Surgery; Demonstrator of Physiology in Jefferson Medical College.

1890. Brush, Edward N., M.D., Medical Superintendent of the Sheppard Asylum, Sheppard, Md.

*1851. Bullock, William R., M.D.

1887. Bunting, Ross R., M.D.

1870. Burnett, Charles H., M.D., Clinical Professor of Otology in the Woman's Medical College; Professor (Emeritus) of Otology in the Philadelphia Polyclinic.

1886. Cadwalader, Charles E., M.D.

1885. Chapin, John B., M.D., Physician to the Pennsylvania Hospital for the Insane.

1880. Chapman, Henry C., M.D., Professor of the Institutes of Medicine and of Medical Jurisprudence in Jefferson Medical College.

1868. Cheston, D. Murray, M.D.

1873. Clark, Leonardo S., M.D.

1872. Cleemann, Richard A., M.D.

*1842. Clymer, Meredith, M.D.

1871. Cohen, J. Solis, M.D., Professor (Emeritus) of Diseases

ELECTED

of the Throat and Chest in the Philadelphia Polyclinic; Professor (Honorary) of Laryngology in Jefferson Medical College; Consulting Physician to the Home for Consumptives, Philadelphia.

1888. Cohen, Solomon Solis, M.D., Professor of Clinical Medicine and Applied Therapeutics in the Philadelphia Polyclinic and Physician to the Polyclinic Hospital; Clinical Lecturer on Medicine in Jefferson Medical College; Visiting Physician to the Philadelphia Hospital; Consulting Physician to the Jewish Hospital.

1866. Cruice, R. B., M.D., Surgeon to St. Joseph's Hospital.

1884. Curtin, R. G., M.D., Lecturer on Physical Diagnosis in the University of Pennsylvania; Assistant Physician to the University Hospital; Physician to the Philadelphia and the Presbyterian Hospitals.

1884. Da Costa, John C., M.D., Gynecologist to Jefferson Medical College Hospital and to St. Agnes Hospital.

1884. Da Costa, J. M., M.D., LL.D., Professor (Emeritus) of the Principles and Practice of Medicine in Jefferson Medical College; Physician to the Pennsylvania Hospital; Consulting Physician to the Children's Hospital and to the Northern Dispensary.

1887. Daland, Judson, M.D., Instructor in Clinical Medicine and Lecturer on Physical Diagnosis and Symptomatology in the University of Pennsylvania; Assistant Physician to the University Hospital; one of the Examiners of the Insane to the Philadelphia Hospital; Visiting Physician to St. Clement's Hospital.

1859. Darrach, James, M.D., Consulting Surgeon to the Germantown Hospital.

1888. Davis, Edward P., M.D., Professor of Obstetrics and Diseases of Children in the Philadelphia Polyclinic; Demonstrator of Obstetrics in Jefferson Medical College; Visiting Obstetrician to the Philadelphia Hospital.

1889. Davis, G. G., M.D., Assistant Surgeon to the Episcopal

ELECTED

and Orthopædic Hospitals; Surgeon to the Dispensary of the Children's Hospital; Assistant Demonstrator of Surgery in the University of Pennsylvania.

1874. Deakyne, A. C., M.D.

*1870. Deal, L. J., M.D.

1887. Deaver, John B., M.D., Associate Professor of Anatomy in the University of Pennsylvania; Surgeon to the Philadelphia Hospital, to the German Hospital, and to St. Mary's Hospital.

1885. Dercum, Francis X., M.D., Instructor in Nervous Diseases in the University of Pennsylvania; Neurologist to the Philadelphia Hospital.

1891. Dixon, Samuel G., M.D., Curator of the Academy of Natural Sciences of Philadelphia.

1891. Dixon, William C., M.D., Physician to Industrial Home for Blind Women, Philadelphia; Physician to the Shelter for Colored Orphans, Philadelphia; Member of Consulting Staff, Philadelphia Home for Incurables; Examiner of Insane Patients, Philadelphia Hospital.

1884. Downs, R. N., M.D.

1884. Drysdale, T. M., M.D.

1864. Duer, Edward L., M.D., Accoucheur to the Philadelphia Hospital; Surgeon to the Maternity Hospital; Visiting Physician to the Preston Retreat.

1871. Duhring, L. A., M.D., Clinical Professor of Skin Diseases to the Hospital of the University of Pennsylvania; Dermatologist to the Philadelphia Hospital; Consulting Physician to the Philadelphia Dispensary for Skin Diseases.

1881. Dulles, Charles Winslow, M.D., Physician to Rush Hospital.

1863. Dunglison, Richard J., M.D.

*1871. Dunglison, Thomas R., M.D.

1888. Dunn, Thomas D., M.D.

*1849. Dunott, Justus, M.D.

1860. Dunton, William R., M.D., Consulting Physician to the Germantown Hospital.

ELECTED

1882. Edwards, Joseph F., M.D.

*1887. Edwards, William A., M.D.

*1880. Eskridge, J. T., M.D.

1868. Evans, Horace Y., M.D., Physician to the Charity Hospital.

1884. Fenton, Thomas H., M.D.

1866. Fischer, Emil, M.D.

1884. Fisher, Henry M., M.D., Physician to the Episcopal Hospital; Microscopist to the Pennsylvania Hospital and Physician to the Out-patient Department of the same.

1888. Flick, Lawrence F., M.D.

1862. Forbes, William S., M.D., Professor of Anatomy in Jefferson Medical College.

1870. Ford, William H., M.D., President of the Board of Health; Physician to the Foster Home.

1884. Formad, H. F., M.D., Lecturer on Experimental Pathology and Demonstrator of Morbid Anatomy in the University of Pennsylvania; Pathologist to the Philadelphia Hospital

1885. Fox, Joseph M., M.D.

1890. Freeman, Walter J., M.D., Clinical Assistant to the Throat Department of the Philadelphia Polyclinic.

1885. Fricke, Albert, M.D.

1889. Fussell, M. Howard, M.D., Chief Physician to the Medical Dispensary of the University of Pennsylvania; Instructor of Clinical Medicine in the University of Pennsylvania.

1873. Gerhard, George S., M.D.

1884. Getchell, F. H., M.D.

1885. Girvin, Robert M., M.D., Gynecologist to the Presbyterian Hospital.

1889. Githens, William H., M.D., Visiting Physician to "The Sheltering Arms."

1884. Godey, Harry, M.D.

ELECTED

1868. Goodell, William, M.D., Professor of Clinical Gynecology in the University of Pennsylvania; Consulting Physician to the Lying-in Department of the Northern Dispensary.

1867. Goodman, H. Ernest, M.D., Professor of Surgery in the Medico-Chirurgical College; Surgeon to Wills Eye Hospital and to the Orthopædic Hospital; Consulting Surgeon to the Maternity Hospital.

1885. Graham, John, M.D.

1891. Green, Walter D., A.M., M.D., Out-patient Surgeon to the Pennsylvania, Children's, and Gynecean Hospitals; Assistant Demonstrator of Surgery in the University of Pennsylvania.

1870. Grier, M. J., M.D.

1873. Griffith J. P. Crozer, M.D., Clinical Professor of the Diseases of Children in the Hospital of the University of Pennsylvania; Professor of Clinical Medicine in the Philadelphia Polyclinic; Physician to St. Agnes, St. Clement's, and the Howard Hospitals, to the Dispensary of the Children's Hospital, and to the Southern Home for Destitute Children.

1871. Grove, John H., M.D., Surgeon to St. Mary's and to St. Agnes Hospitals.

1889. Guitéras, John, M.D., Professor of General Pathology and Morbid Anatomy in the University of Pennsylvania.

1863. Hall, A. Douglass, M.D., Surgeon to Wills Eye Hospital.

1890. Hall, John C., M.D.

*1859. Hammond, William A., M.D., Surgeon-General U. S. A. Retired.

1886. Hansell, Howard F., M.D., Chief Clinical Assistant to the Ophthalmological Department of Jefferson Medical College Hospital; Ophthalmic and Aural Surgeon to the Southwestern Hospital.

1889. Hare, Hobart A., M.D., Professor of Therapeutics and Materia Medica in Jefferson Medical College; Physician

ELECTED

to St. Agnes Hospital and to Jefferson Medical College Hospital.

1865. Harlan, George C., M.D., Surgeon to Wills Eye Hospital and to the Eye and Ear Department of the Pennsylvania Hospital; Professor (Emeritus) of Diseases of the Eye in the Philadelphia Polyclinic.

1863. Harlow, Lewis D., M.D.

1862. Harris, Robert P., M.D.

1885. Harte, Richard H., M.D., Demonstrator of Osteology in the University of Pennsylvania and Assistant Surgeon to the Hospital; Surgeon to the Out-patient Department of the Pennsylvania Hospital.

1851. Hartshorne, Henry, M.D., LL.D.

1888. Hartzell, Milton B., M.D., Pathologist to the Presbyterian Hospital; Assistant Physician to the Dispensary for Skin Diseases, University of Pennsylvania.

*1849. Hastings, John, M.D.

1872. Hays, I. Minis, M.D.

1882. Hearn, W. Joseph, M.D., Surgeon to the Hospital of Jefferson Medical College and to the Philadelphia Hospital.

1884. Henry, Frederick P., M.D., Physician to Jefferson Medical College Hospital and to the Philadelphia Hospital; Professor of the Principles and Practice of Medicine in the Woman's Medical College of Pennsylvania.

1891. Hewson, Addinell, A.M., M.D., Demonstrator of Anatomy in Jefferson Medical College; Chief Clinical Assistant in the Surgical Dispensary of Jefferson Medical College Hospital; Dispensary Surgeon to the Hospital of the Protestant Episcopal Church.

1872. Hinkle, A. G. B., M.D.

1888. Hirsh, Abram B., M.D.

1888. Hirst, Barton Cooke, M.D., Professor of Obstetrics in the University of Pennsylvania; Obstetrician to the Philadelphia Hospital and to the Maternity Hospital.

ELECTED

1885. Holland, James W., M.D., Professor of Medical Chemistry and Toxicology in Jefferson Medical College.

1879. Hopkins, William Barton, M.D., Surgeon to the Episcopal Hospital and to the Out-patient Department of the Pennsylvania Hospital.

1867. Horn, George H., M.D., Professor of Entomology in the Biological Department of the University of Pennsylvania.

1888. Horwitz, Orville, M.D., Demonstrator of Surgery in Jefferson Medical College; Chief Clinical Assistant in the Surgical Dispensary of Jefferson Medical College Hospital; Surgeon to the Philadelphia Hospital.

1868. Howell, Samuel B., M.D.

*1881. Huidekoper, Rush Shippen, M.D.

1884. Hunt, J. Gibbons, M.D.

1854. Hunt, William, M.D., Surgeon to the Pennsylvania Hospital.

1871. Ingham, James V., M.D.

1885. Jackson, Edward, M.D., Professor of Diseases of the Eye in the Philadelphia Polyclinic; Surgeon to Wills Eye Hospital; Ophthalmologist to Rush Hospital.

1887. Jayne, Horace, M.D., Professor of Vertebrate Morphology in the Biological Department of the University of Pennsylvania.

1885. Judd, Leonardo Da Vinci, M.D.

1867. Judson, Oliver A., M.D.

1886. Jurist, Louis, M.D., Chief Clinical Assistant in the Laryngological Department of Jefferson Medical College Hospital.

*1877. Keating, John M., M.D., Physician to St. Joseph's Hospital and to the Howard Hospital.

1849. Keating, William V., M.D., Physician to St. Joseph's Hospital.

ELECTED

1867. KEEN, WILLIAM W., M.D., LL.D., Professor of the Principles of Surgery and of Clinical Surgery in Jefferson Medical College; Surgeon to Jefferson Medical College Hospital, to the Orthopædic Hospital and Infirmary for Nervous Diseases, and to St. Agnes Hospital.

*1887. KELLY, HOWARD A., M.D., Professor of Gynecology in the Johns Hopkins University, and Gynecologist and Obstetrician to the Hospital.

*1844. KING, CHARLES R., M.D.

1875. KIRKBRIDE, JOSEPH J., M.D.

*1865. LA ROCHE, C. PERCY, M.D.

1887. LEAMAN, HENRY, M.D.

1883. LEFFMANN, HENRY, M.D., Professor of Chemistry in the Philadelphia Polyclinic and in the Woman's Medical College; Pathological Chemist to Jefferson Medical College Hospital.

1855. LEWIS, FRANCIS W., M.D.

1877. LEWIS, MORRIS J., M.D., Physician to the Children's Hospital, to the Orthopædic Hospital and Infirmary for Nervous Diseases, and to the Pennsylvania Hospital.

1886. LLOYD, J. HENDRIE, M.D., Physician to the Nervous and Insane Department of the Philadelphia Hospital, to the Methodist Episcopal Hospital, and to the Home for Crippled Children.

1877. LONGSTRETH, MORRIS, M.D., Professor of Pathological Anatomy in Jefferson Medical College; Physician to the Pennsylvania Hospital.

1886. MACCOY, ALEXANDER W., M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic; Lecturer on Diseases of the Throat and Nose in the Woman's Medical College of Pennsylvania.

1875. MCCLELLAN, GEORGE, M.D., Surgeon to the Howard Hospital.

1871. MCFERRAN, J. A., M.D.

*1885. MALLET, JOHN W., M.D.

ELECTED

1889. Martin, Edward, M.D., Surgeon to the Howard Hospital; Clinical Professor of Genito-Urinary Surgery to the Hospital of the University of Pennsylvania.

1887. Massey, Isaac, M.D., Surgeon to the Pennsylvania Railroad.

*1850. Mayer, Edward R., M.D.

1885. Mays, Thomas J., M.D., Professor of Diseases of the Chest and of Experimental Therapeutics in the Philadelphia Polyclinic; Visiting Physician to Rush Hospital.

1868. Mears, J. Ewing, M.D., Professor of Anatomy and Clinical Surgery in the Pennsylvania College of Dental Surgery; Gynecologist to Jefferson Medical College Hospital; Surgeon to St. Agnes Hospital.

1875. Meigs, Arthur V., M.D., Physician to the Pennsylvania Hospital and to the Children's Hospital; Consulting Physician to the Pennsylvania Institution for the Instruction of the Blind.

*1884. Mifflin, Houston, M.D.

1881. Mills, Charles K., M.D., Professor of Diseases of the Mind and Nervous System in the Philadelphia Polyclinic; Clinical Professor of Mental Diseases in the University of Pennsylvania, and of Nervous Diseases in the Woman's Medical College; Neurologist to the Philadelphia Hospital, and Consulting Physician to the Department for the Insane of the Philadelphia Hospital.

1888. Mitchell, John K., M.D., Instructor in Clinical Medicine in the University of Pennsylvania; Physician to St. Agnes Hospital; Assistant Physician to the University Hospital and to the Infirmary for Nervous Diseases.

1856. Mitchell, S. Weir, M.D., Professor of Diseases of the Mind and Nervous System in the Philadelphia Polyclinic; Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Physician to the Maternity Hospital.

1882. Montgomery, Edward E., M.D., Professor of Gynecology and of Clinical Gynecology in the Medico-Chirur-

ELECTED

gical College; Obstetrician to the Philadelphia Hospital.

1863. Morehouse, George R., M.D., Physician to St. Joseph's Hospital.

1886. Morris, Caspar, M.D., Physician to the Episcopal Hospital and to the Out-patient Department of the Pennsylvania Hospital.

1883. Morris, Henry, M.D., Gynecologist to the Howard Hospital.

1856. Morris, J. Cheston, M.D.

1861. Morton, Thomas G., M.D., Surgeon to the Pennsylvania and the Orthopædic Hospitals; Consulting Surgeon to the Jewish Hospital: Emeritus Surgeon to Wills Eye Hospital.

1891. Morton, T. S. K., M.D., Professor of Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Surgeon to the Polyclinic Hospital; Assistant Surgeon to the Orthopædic Hospital.

1864. Moss, William, M.D.

1890. Müller, Auguste F., M.D., Attending Physician to the Germantown Hospital.

1882. Musser, John H., M.D., Assistant Professor of Clinical Medicine in the University of Pennsylvania; Physician to the Philadelphia Hospital and to the Presbyterian Hospital; Consulting Physician to the Woman's Hospital of Philadelphia and to the West Philadelphia Hospital for Women.

1886. Neff, Joseph F., M.D.

1887. Neilson, Thomas Rundle, M.D., Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Adjunct Professor of Genito-Urinary Diseases in the Philadelphia Polyclinic; Assistant Demonstrator of Anatomy in the University of Pennsylvania.

1889. Noble, Charles P., M.D., Surgeon-in-Chief to the Kensington Hospital for Women; Surgeon-in-charge of

ELECTED

the Department for Women of the Northern Dispensary; Surgeon-in-charge of the Department for Women of the Union Dispensary; Lecturer on Gynecology in the Philadelphia Polyclinic.

1869. Norris, Herbert, M.D., Supervising Physician to St. Clement's Hospital.

1865. Norris, Isaac, Jr., M.D.

1866. Norris, William F., M.D., Honorary Professor of Ophthalmology and Clinical Professor of Diseases of the Eye in the University of Pennsylvania; Surgeon to Wills Eye Hospital.

1884. Oliver, Charles A., M.D., Attending Surgeon to Wills Eye Hospital; Ophthalmic Surgeon to the Presbyterian Hospital; Consulting Ophthalmic Surgeon to St. Agnes, St. Timothy's, and the Maternity Hospitals.

1884. O'Neill, J. W., M.D.

*1885. Osler, William, M.D., Professor of Medicine in Johns Hopkins University, and Physician to the Hospital.

1890. Packard, Frederick A., M.D., Physician to the Medical Dispensary of the Episcopal Hospital; Visiting Physician to the Methodist Episcopal Hospital; Instructor in Physical Diagnosis in the University of Pennsylvania.

1858. Packard, John H., M.D., Surgeon to the Pennsylvania Hospital and to St. Joseph's Hospital.

1864. Pancoast, William H., M.D., Professor of Anatomy and of Clinical Surgery in the Medico-Chirurgical College; Consulting Surgeon to the Philadelphia Hospital for Skin Diseases.

1882. Parish, William H., M.D., Professor of Obstetrics in the Dartmouth Medical College; Professor of Anatomy in the Woman's Medical College of Pennsylvania; Consulting Obstetrician to the Lying-in Charity; Consulting Surgeon to the Kensington Hospital; Consulting Gynecologist to St. Agnes Hospital.

ELECTED

1883. Parvin, Theophilus, M.D., Professor of Obstetrics and Diseases of Women and Children in Jefferson Medical College; Obstetrician to the Philadelphia Hospital.

1889. Penrose, Charles Bingham, M.D., Surgeon to the Gynecean Hospital; Surgeon to the Out-patient Department of the Pennsylvania and St. Agnes Hospitals; Assistant Surgeon to the University Hospital.

1854. Penrose, R. A. F., M.D., LL.D., Professor (Emeritus) of Obstetrics and Diseases of Women and Children in the University of Pennsylvania; Consulting Obstetrician to the Maternity Hospital; Visiting Physician to the Preston Retreat.

1868. Pepper, William, M.D., LL.D., Provost of the University of Pennsylvania and Professor of the Theory and Practice of Medicine in the same.

1884. Perkins, Francis M., M.D., Ophthalmic and Aural Surgeon to the Dispensary of St. Mary's Hospital; Visiting Ophthalmic Surgeon to the Hospital of the Good Shepherd at Radnor.

1890. Phillips, J. Willoughby, M.D.

1883. Piersol, George A., M.D., Professor of Anatomy in the University of Pennsylvania.

1862. Porter, William G., M.D., Surgeon to the Presbyterian Hospital and to the Philadelphia Hospital.

1885. Potter, Thomas C., M.D.

1887. Price, Jacob, M.D.

1889. Price, Joseph, M.D., Physician-in-charge of the Preston Retreat and of the Female Department of the Philadelphia Dispensary.

1889. Randall, B. Alexander, M.D., Professor of Otology in the University of Pennsylvania and in the Philadelphia Polyclinic; Ophthalmic and Aural Surgeon to the Children's Hospital.

1887. Reed, Charles H., M.D.

1842. Reese, John J., M.D.

ELECTED

1885. Reichert, Edward T., M.D., Professor of Physiology in the University of Pennsylvania.

1888. Rex, George A., M.D.

1883. Rex, Oliver P., M.D., Clinical Lecturer on Diseases of Children in Jefferson Medical College, and Physician to the Hospital; Physician to the Presbyterian Hospital.

1891. Rhoads, Edward G., M.D.

1891. Risley, S. D., M.D., Lecturer on Ophthalmology in the University of Pennsylvania; Attending Surgeon at Wills Eye Hospital; Professor of Ophthalmology in the Philadelphia Polyclinic and College for Graduates in Medicine.

1882. Roberts, A. Sydney, M.D.

1878. Roberts, John B., M.D., Professor of Anatomy and Surgery in the Philadelphia Polyclinic; Professor of Surgery in the Woman's Medical College of Pennsylvania; Lecturer on Anatomy in the University of Pennsylvania; Consulting Surgeon to the Jewish Hospital; Surgeon to St. Agnes Hospital.

1888. Robins, Robert P., M.D., Visiting Physician to the Dispensary of the House of Industry, to the Church Home for Children, and to the Board of Guardians of the Poor; Lecturer on Chemistry in the Episcopal Academy.

1838. Ruschenberger, W. S. W., M.D., Medical Director, U. S. N.

*1852. Sargent, Fitz William, M.D.

*1864. Sargent, Winthrop, M.D.

1866. Schaffer, Charles, M.D., Professor of Botany in the Pennsylvania Horticultural Society.

1877. De Schweinitz, George E., M.D., Professor of Ophthalmology in the Philadelphia Polyclinic; Ophthalmic and Aural Surgeon to the Children's Hospital; Ophthalmologist to the Orthopædic Hospital and to the Philadelphia Hospital; Assistant Surgeon to the Dispensary for Diseases of the Eye in the University of Pennsylvania.

ELECTED

1888. Seltzer, Charles M., M.D.

1875. Seyfert, Theodore H., M.D.

1884. Shaffner, Charles, M.D., Ophthalmic Surgeon to the Presbyterian Hospital; Surgeon to Pennsylvania Eye and Ear Infirmary.

1877. Shakespeare, Edward O., M.D., Pathologist to the Philadelphia Hospital.

1868. Shapleigh, E. B., M.D.

1876. Shippen, Edward, A.M., M.D., Medical Director U. S. N.

1891. Shober, John B., M.D., Surgeon to the University Hospital Dispensary and to the Gynecean Hospital Dispensary; Examining Surgeon for Pensions, Philadelphia.

1890. Shoemaker, George Erety, A.M., M.D., Visiting Surgeon to St. Clement's Hospital; Out-patient Surgeon to the Presbyterian Hospital and to the University Hospital.

1880. Simes, J. H. C., M.D., Professor of Genito-Urinary and Venereal Diseases in the Philadelphia Polyclinic; Surgeon to the Episcopal Hospital and to St. Christopher's Hospital.

1873. Simpson, James, M.D., Physician to St. Mary's Hospital.

1872. Sinkler, Wharton, M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Neurologist to the Philadelphia Hospital.

*1863. Smith, A. K., M.D., U. S. A.

*1864. Smith, Edward A., M.D.

1884. Smith, Robert Meade, M.D., Professor of Comparative Physiology in the University of Pennsylvania.

1875. Starr, Louis, M.D., Physician to the Children's Hospital; Consulting Physician to the Maternity Hospital.

1884. Stelwagon, Henry W., M.D., Clinical Professor of Dermatology in the Woman's Medical College; Clinical Lecturer on Dermatology in Jefferson Medical College; Dermatologist to the Philadelphia Hospital; Physician to the Department for Skin Diseases of the Howard Hospital and the Northern Dispensary.

1888. Stewart, David D., M.D., Lecturer and Demonstrator

ELECTED

of Diseases of the Nervous System and Chief of the Neurological Clinic in Jefferson Medical College; Physician to St. Mary's and St. Christopher's Hospitals.

1842. Stillé, Alfred, M.D., LL.D., Professor (Emeritus) of the Theory and Practice of Medicine in the University of Pennsylvania; Consulting Physician to the Maternity Hospital and to the Woman's Hospital.

1846. Stocker, Anthony E., M.D.

1884. Stryker, S. S., M.D, Obstetrician to the Philadelphia Hospital.

1886. Taylor, John Madison, M.D., Physician to Howard Hospital; Assistant Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Physician to the Dispensary of the Children's Hospital; Instructor in Children's Diseases in the Philadelphia Polyclinic.

1867. Taylor, R. R., M.D.

1887. Taylor, William J., M.D., Surgeon to St. Mary's Hospital and Assistant Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases.

1886. Taylor, William L., M.D., Instructor in Clinical Gynecology in the University of Pennsylvania, and Chief of the Clinic and Assistant Gynecologist to the Hospital of the same; Surgeon-in-Chief to the Beacon Service for Women.

1867. Thomas, Charles H., M.D.

1869. Thomson, William, M.D., Professor (Honorary) of Ophthalmology in the Jefferson Medical College and Ophthalmic Surgeon to the Hospital of the same; Emeritus Surgeon to the Wills Eye Hospital.

*1854. Tilden, W. P., M.D.

*1870. Turner, A. Paul, M.D.

1866. Tyson, James, M.D., Professor of Clinical Medicine in the University of Pennsylvania; Physician to the University Hospital.

1864. Vandyke, E. B, M.D.

1873. Van Harlingen, Arthur, M.D., Professor of Diseases

ELECTED

of the Skin in the Philadelphia Polyclinic; Dermatologist to the Howard Hospital.

1883. Vinton, Charles Harrod, M.D.

1885. Walker, James B., M.D., Attending Physician to the Philadelphia Hospital; Lecturer on Clinical Medicine and Consulting Physician to the Woman's Hospital.

1886. Watson, E. W., M.D.

1875. Webb, William H., M.D.

1883. Welch, William M., M.D., Physician to the Municipal Hospital for Contagious Diseases; Lecturer on Exanthemata and Vaccinia in the Medico-Chirurgical College.

1884. Wharton, H. R., M.D., Demonstrator of Surgery in the University of Pennsylvania and Assistant Surgeon to the Hospital of the same; Surgeon to the Children's Hospital, the Presbyterian Hospital, and the Methodist Episcopal Hospital; Surgeon to Rush Hospital.

1883. Whelen, Alfred, M.D.

1878. White, J. William, M.D., Professor of Clinical Surgery in the University of Pennsylvania; Surgeon to the Maternity Hospital.

1880. Willard, DeForest, M.D., Clinical Professor of Orthopædic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital: Consulting Surgeon to the White and to the Colored Cripples' Homes and to the Home for Incurables.

*1878. Williamson, Jesse, M.D.

1881. Wilson, H. Augustus, M.D., Professor of General and Orthopædic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Clinical Professor of Orthopædic Surgery in the Woman's Medical College of Pennsylvania; Clinical Lecturer on Orthopædic Surgery in Jefferson Medical College; Consulting Surgeon to the Kensington Hospital for Women.

1874. Wilson, James C., M.D., Professor of the Principles and Practice of Medicine in Jefferson Medical College and

ELECTED

Physician to the Hospital of the same; Physician to the German Hospital.

1884. Wirgman, Charles, M.D., Physician to the Hospital of Jefferson Medical College and to the Howard Hospital.

1852. Wister, Owen Jones, M.D., Consulting Surgeon to the Germantown Hospital.

1865. Wood, Horatio C., M.D., Professor of Materia Medica, Pharmacy, and General Therapeutics in the University of Pennsylvania, and Clinical Professor of Diseases of the Nervous System in the Hospital of the same.

1880. Woodbury, Frank, M.D., Honorary Professor of Clinical Medicine in the Medico-Chirurgical College of Philadelphia, and Physician to the Hospital of the same.

1866. Woods, D. F., M.D., Physician to the Presbyterian Hospital.

1888. Woodward, Charles E., M.D., Physician to the Chester Co. Prison and West Chester Board of Health; U. S. Examining Surgeon.

1878. Wormley, Theodore G., M.D., LL.D., Professor of Chemistry in the University of Pennsylvania; U. S. Examining Surgeon.

1860. Wurts, Charles Stewart, M.D.

1861. Yarrow, Thomas J., M.D.

1889. Young, James K., M.D., Instructor in Orthopædic Surgery and Assistant Demonstrator of Surgery in the University of Pennsylvania; Orthopædic Surgeon in the Out-patient Department of the Hospital.

1887. Zeigler, Walter M. L., M.D., Assistant Aural Surgeon and Chief of the Dispensary for Diseases of the Ear in the Hospital of the University of Pennsylvania.

[It is particularly requested that any change of appointment, or any error in the titles of Fellows as published, may be communicated to the Committee of Publication before the first of November in each year, in order that the list may be made as nearly correct as possible.]

ASSOCIATE FELLOWS.

[Limited to Fifty, of whom Twenty may be Foreigners.]

ELECTED

1873. Ackland, Henry W., M.D., F.R.S., Oxford, England.
1890. Bacelli, Guido, Rome, Italy.
1877. Barnes, Robert, M.D., London, England.
1876. Billings, John S., M.D., U. S. A., Washington, D. C.
1876. Bowditch, Henry I., M.D., Boston, Massachusetts.
1886. Bowditch, Henry P., M.D., Boston, Massachusetts.
1865. Butcher, R. G., M.D., M.R.C.S., Dublin, Ireland.
1877. Chaillé, Stanford E., M.D., New Orleans, Louisiana.
1886. Cheever, David W., M.D., Boston, Massachusetts.
1876. Comegys, C. G., M.D., Cincinnati, Ohio.
1876. Corson, Hiram, M.D., Norristown, Pennsylvania.
1876. Davis, N. S., M.D., Chicago, Illinois.
1886. Draper, William H., M.D., New York.
1883. Fayrer, Sir Joseph, M.D., LL.D., F.R.S., London, England.
1876. Green, Traill, M.D., Easton, Pennsylvania.
1883. Heath, Christopher, F.R.C.S., London, England.
1874. Jackson, J. Hughlings, M.D., London, England.
1891. Jacobi, A., M.D., New York.
1876. Johnson, George, M.D., F.R.S., London, England.
1876. Jones, Joseph, M.D., New Orleans, Louisiana.
1876. King, James, M.D., Pittsburg, Pennsylvania.
1877. Lister, Sir Joseph, Bart., M.D., LL.D., F.R.S., London, England.
1865. Macleod, G. H. B., M.D., Glasgow, Scotland.
1886. McGuire, Hunter, M.D., Richmond, Virginia.
1876. Moore, E. M., M.D., Rochester, New York.

ELECTED

1876. Mowry, R. B., M.D., Allegheny City, Pennsylvania.
1873. Ogle, John W., M.D., London, England.
1874. Paget, Sir James, Bart., M.D., LL.D., F.R.S., D.C.L., London, England.
1876. Pollock, A.M., M.D., Pittsburg, Pennsylvania.
1876. Porcher, F. Peyre, M.D., Charleston, South Carolina.
1886. Reeve, John C., M.D., Dayton, Ohio.
1887. Richardson, Tobias G., M.D., New Orleans, Louisiana.
1886. Senn, Nicholas, M.D., Milwaukee, Wisconsin.
1886. Shattuck, George C., M.D., Boston, Massachusetts.
1886. Thomas, T. Gaillard, M.D., New York.
1869. Valcourt, Th. de, M.D., Cannes, France.
1886. Whittaker, James T., M.D., Cincinnati, Ohio.
1886. Yandell, David W., M.D., Louisville, Kentucky.

CORRESPONDING MEMBERS.

ELECTED

1880. Carrow, Fleming, M.D., United States.
1880. Chiara, Domenico, M.D., Florence, Italy.
1886. Dey, Kanny Loll, M.D., Calcutta, India.
1889. Fedeli, Gregorio, M.D., Rome, Italy.
1885. Rendu, Jean, M.D., Lyons, France.
1886. Richards, Vincent, Goalunda, India.
1889. Strahan, John, M.D., Belfast, Ireland.

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THE PRESIDENT'S ANNUAL ADDRESS.

By D. HAYES AGNEW, M.D.

[Delivered December 2, 1891.]

Fellows of the College of Physicians: With this meeting my official services as your President terminate, and it only remains for me, as a last duty, to lay before you a brief summary of the affairs of our College, all the departments of which I believe to be in a fairly prosperous condition. The papers contributed by Fellows (fifteen in number) have been of an excellent, and in some instances of a highly original character; and the discussions have been conducted in a dignified and courteous spirit. Owing to the unusually prompt payment of annual dues the income of the College is greatly in excess of that realized during the preceding year, and as I am informed by our Treasurer, there has been added to the permanent fund, for the year 1891, over seven hundred dollars. In addition to this the College has received, through the watchful interest of our honored Vice-President, from Samuel Clarkson, Esq., the sum of one hundred dollars, and from Mrs. Lewis Rodman, in memory of her husband, Dr. Lewis Rodman, a former Fellow of the College, the sum of five thousand dollars—one thousand of which has been paid—both sums to constitute a nucleus for the founding of a library endowment fund. A valuable portrait, in oil, of Dr. Rodman will also be presented at a future meeting of the College.

The additions to the library during the present year amount to twenty-two hundred volumes, making a grand total of 40,000, not including eighteen thousand unbound pamphlets and reports at present on hand. In this connection it is proper to say that in

consequence of the increasing number of books received from year to year, the Library Committee is greatly embarrassed in its work for the want of the necessary accommodations: being compelled to distribute many of the books over the floor of the gallery.

The additions to the Mütter Museum for the year 1891 number eighty-two, consisting of pathological specimens and photographs, presented by Fellows and by other members of the profession. There have also been purchased, for this department, twenty-eight works illustrative of anatomy and surgical pathology.

In connection with the museum it would be an unpardonable omission not to speak of the course of valuable lectures delivered by Professor Roswell Park, of Buffalo, on "Surgical Bacteriology," which attracted a very large and interested attendance.

As in the past, so in the present year, the Directory for Nurses, under its able management, has materially aided our library. The value of this directory, both to the community and to the College, is incalculable, and you will pardon me for again pressing on the attention of Fellows the necessity for their increased patronage and influence in enlarging the field of its operation.

The death-roll of Fellows for the present year has been unusually large. Of non-resident Fellows, Dr. Ferdinand H. Gross died February 17th, and Dr. S. Preston Jones on March 13th. Of resident Fellows, Dr. Thomas B. Reed died April 1st; Dr. Philip Leidy, April 29th; Dr. Joseph Leidy, April 30th, and Dr. James F. Wilson on June 25th, and on May 30th Associate Fellow Dr. Fordyce Barker.

Last year the College set apart a room for the accommodation of those interested in ophthalmology. The meetings of this body of specialists have been well attended. Seven valuable original papers were contributed by those participating in these meetings, and many interesting and instructive cases, illustrating diseases of the eye, were presented.

The last subject, to which I will briefly allude, is one touching the conditions for admission to the privileges of membership in this body.

Are the requirements for Fellowship as high as they should be? Are its doors of admission thrown too widely open? Is there not

some danger that the matter of emolument may come to outweigh other and weightier considerations? These are questions which I think may be asked with propriety. The College was designed to be, and should be, a thoroughly representative body, and its seats should be occupied by those who, after years (perhaps nine or ten) of professional toil, or by literary labors or original research, have achieved distinction in one or several of the departments of medicine. I may possibly be charged with an attempt to raise an aristocracy in medicine; and there should be an aristocracy—not, however, in an offensive sense, not one based on wealth, family, or social considerations, but on merit, and merit alone, and as accessible to the humblest as to the most favored member of our noble profession.

AN EFFORT TO OBTAIN A PERFECT SUBSTITUTE FOR HUMAN MILK.

Based on Chemical and Clinical Studies.

By BARTON COOKE HIRST, M.D.,
PROFESSOR OF OBSTETRICS IN THE UNIVERSITY OF PENNSYLVANIA.

[Read January 7, 1891.]

There is no more important subject in obstetric practice to-day than the artificial alimentation of infants. Indeed, there are few questions in the whole realm of medicine that transcend it in interest. In this city, in the past three years, 1887 to 1889 inclusive, there have been, in round numbers, 75,000 living children born; during the same period 16,000 children have died before completing their first year—a death-rate of something over 21 per cent.[1] In other words, one-fifth of the children born alive in Philadelphia die before they are one year old—a stupendous mortality, but other large cities show a still worse record. The chief cause of the high death-rate is undoubtedly to be found in diseases of the digestive tract, which come from bad feeding. This does not appear so plainly as it should in the mortality records of the city. One needs little experience to learn that fatal cases of intestinal infection in young children are reported in the death-certificates under all sorts of misleading names, such as marasmus,

[1] In exact number as follows:

1887—23,140	living births,	5296	deaths	under	one	year.	
1888—25,163	"	"	4977	"	"	"	"
1889—26,244	"	"	5268	"	"	"	"

cerebritis, convulsions, inanition, debility, etc. But the fact remains indisputable, that, if digestive disturbances could be eliminated from the fatal disorders of infancy, a vast army of children would be saved to their parents, and a large number of citizens be added to the State, with a gain, from a humanitarian point of view, that is incalculable, and from a purely material point of view that could be reckoned in enormous sums of money.

By the march of modern investigation such a result, in great part at least, has become a possibility. It needs only a wide dissemination among the laity and the medical profession of knowledge now in the possession of, comparatively, a few, greatly to reduce the mortality of early infancy. That a large number of physicians need instruction on this subject cannot be denied. Last summer I saw two striking illustrations of the fact. In one case, a child of three months was fed, by order of its physician, on a mixture of one teaspoonful of condensed milk to sixty of water. It had come to the verge of starvation on its diet. In the other case a baby eight weeks old had been ordered by the family physician, in the heat of summer, six ounces of unsterilized milk with Mellin's food every two hours. The child died of cholera infantum. Both these physicians were in active general practice, and I dare say that the children who had fallen victims to their ideas on infant-feeding could be counted in large numbers. And these are but single examples of a large class.

The disadvantages attaching to the use of cow's milk—the only practical substitute for human milk—in the feeding of infants may be summed up as follows:

Cow's milk differs in the proportions of its chemical constituents from human milk.

Cow's milk, as ordinarily obtained, especially in summer, swarms with many varieties of microbes, and is contaminated, perhaps, with the products of their activity. It is, moreover, acid. Human milk, on the contrary, is drawn from the breast and received into the infant's stomach sterile. It is alkaline.

Cow's milk can be administered in almost unlimited quan-

tities and at any interval. Human milk is supplied by the mother's breast, in quantities and at intervals suited to the demand of her infant's economy.

Each of these factors could defeat an attempt to nourish an infant on cow's milk alone; but, operating together, as has usually been the case, it is little wonder that artificial infant-feeding in the past was one long record of failures. To the theoretical student of the subject at present it might seem that every difficulty has been removed. With the knowledge obtained by a comparative chemical study of cow's milk and human milk, notably by Arthur V. Meigs's work, one can construct, with cow's milk as a basis, a correct chemical imitation of human milk.[1] By the labors of Jeffries, Soxhlet, and others, the chemical imitation of human milk can be administered in a sterile condition. And by the investigations of Snitkin, L. Emmett Holt, and others, we have definite and correct ideas in regard to the quantity of food to be given at each feeding, the interval that should elapse between the feedings, and the rate of increase in quantity required from month to month. With such knowledge, which is but recently available, it would seem possible to construct an artificial infant-food equal in all respects to the mother's milk. But the confidence inspired by this idea would sooner or later be rudely shaken in practice.

For some time my own experience led me to hope that we had at last secured the ideal infant's food. My system, based on Meigs's and Rotch's work, with sterilization and adjustment of quantity and interval to the infant's age, is expressed

[1] The future has much to teach us in the comparative chemistry of proteids in milk. In Meigs's formula, that which is designated by the loose and incorrect term "casein," but which should be known as caseinogen, is reduced to the proportion of this substance usually found in human milk. But the information which physiological chemists must, before long, furnish practical workers in regard to the relative proportions of lact-albumin in the two milks, and as to the quantity of whey-proteid which appears on the formation of the curd or casein, may, and I think will, necessitate a change in the formula for constructing a chemical imitation of human milk. In this connection see the interesting article by Halliburton, Journal of Physiology, xi. 6, November, 1890.

upon the card which I had printed for distribution among those of my patients who required it.

CARD No. 1.

1. Have ten bottles prepared clean every morning.
2. Put in each of them, through a clean glass funnel:

Cream	dr. iv.
Milk	dr. ij.
Water	oz. j.
Milk sugar	gr. l.—[One measure.]

3. Stopper the mouth of each bottle with dry baked cotton, and sterilize for twenty minutes.
4. Set aside to cool.
5. Add lime-water, dr. ij, to each bottle before use.
6. Apply a plain rubber nipple to the bottle.
7. Warm to blood-heat in warming-cup.

For a time, I say, this plan yielded the most gratifying results. One child, in particular, I recollect. It weighed ten pounds at birth. The mother had fever for about three weeks after delivery, from an infected endometrium, during which time the child was kept upon the bottle. After a while the mother's milk gradually increased in quantity, so that at the end of the first month the infant was fed at the breast, with the exception of a bottle morning and evening. A week later the child was seized with acute dyspeptic symptoms and diarrhœa. I attributed the trouble to the artificial feeding, which I ordered discontinued; but the child grew worse. The mother's milk was then analyzed, and found to contain but 0.8 per cent. of fat, with 1.17 per cent. of casein. The artificial feeding was resumed, and the little patient at once picked up, gaining from that time an average of two pounds a month up to the last report that I received at the sixth month. But soon there came a succession of failures. The most conspicuous was in the case of a healthy infant born at term of exceptionally healthy and well-developed parents. From the first it was necessary to give this child the bottle. It did not thrive. On the contrary, by the third week it had become obstinately constipated and was visibly wasting away. From my own observation, and from what I had heard of others'

experience, I had already learned to suspect that sterilization is the disturbing factor in the effort to produce an ideal infant-food. Consequently, the infant was taken from the mixture described on the card, and put upon condensed milk (1 part), water (12 parts), and cream (1 drachm to an ounce of the mixture). The change in the child's condition was rapid and striking, and at the third month, when I saw it last, it had become in weight, color, and appearance as fine a specimen as one would wish to see.

About this time I assumed charge of the children's wards in the Philadelphia Hospital, with the determination to learn what change sterilization caused in the chemical imitation of human milk and to find a way, if possible, of obviating the alteration. On first thought it seemed that the trouble lay in a disturbance by heat of the chemical constitution of the mixture. It had been asserted that, in boiling, milk loses 3 per cent. of gases (CO_2,N,O) and that 20 per cent. of the albuminoids is coagulated in a thick scum upon the surface (Townsend), and I thought that sterilization might also be productive of a somewhat similar chemical change. But on further consideration, and especially after reading two very interesting articles by Béchamp,[1] it seemed more reasonable to suppose that the unfavorable action of heat upon milk consists in a coagulation of the albumin, especially that around the fat globules, making them, already tougher than in human milk, still more tough and difficult of disintegration in the process of digestion. The question, however, could only be settled by a careful chemical study, and this Dr. Hiestand very kindly undertook for me. The interesting report of the work, just concluded, follows in full:

Notes on the Effect of Sterilization upon Milk.

"To determine what changes occur in milk as a result of sterilization, analyses were made of numerous samples of

[1] Bulletin de l'Académie, 3d série, t. xx. p. 718, and Ibid., t. xxiv. p. 214. Béchamp shows that the fat globules in milk are surrounded by a pellicle of albumin; that in human milk this pellicle is more delicate, and more distensible, than in cow's milk.

normal cow's milk and of the feeding mixture used by Dr. Hirst.[1] The results of these experiments showed no change in the total solids of any sample examined before and after sterilization. The amount of albuminoids, fat, sugar, and salts in a given sample of normal milk, or of the feeding mixture referred to, may be recovered after sterilization without loss.

"Subsequent experiments show, however, that the organic constituents do undergo certain important alterations in condition which bear upon the question of assimilation. Observations were directed mainly toward the condition of the albuminoids, fat, and sugar, with the following results:

"ALBUMINOIDS.—A. Sterilized and unsterilized portions of a milk-sample were saturated with magnesium sulphate, the precipitated casein separated by filtration, and the albumin estimated in the filtrate. The unsterilized sample yielded 0.33 per cent. of albumin; the sterilized only 0.013 per cent., about 96 per cent. of the albumin, in the latter case, having been coagulated by heat and carried down with the casein.

"B. The percentage of casein in the foregoing sample of milk was 3.27, as shown by a calculation based upon the total nitrogen in the milk. On account of the difficulty of separating the coagulated albumin from the precipitated casein, no observations were made on the condition of the casein before and after sterilization.

"A number of experiments to determine the changes in casein after boiling have been undertaken by various observers; but, thus far, the results have been too conflicting to be reliable. Soldner (quoted in the report of the United States Department of Agriculture, 1890) gives some notes made by Hammersten to the effect that the casein in milk is changed by a temperature of 212° F. The evidence seems to be that the calcium in milk is in some way combined with the casein, and that this combination is modified by a boiling temperature. The exact nature of this change is not well understood. It seems probable, however, that an alkaline calcium compound

[1] See card No. 1.

is formed, which may overcome the natural acidity of the milk. This would explain the altered behavior of rennet in sterilized milk. The experiments incident to his report corroborate those of previous observers and show that sterilized milk coagulates with rennet much less promptly than unsterilized milk. The addition of a small quantity of acid is found to restore to the milk its coagulability by rennet, probably by overcoming the alkalinity produced by boiling.

"II. FAT.—After sterilization the milk was covered with what appeared to be a thin layer of butter-fat. To ascertain whether any fat-globules were freed from their albuminous envelopes, a portion of sterilized milk was rotated in a centrifugal machine for several minutes, along with an equal quantity of unsterilized milk in a separate flask. It was observed that a noticeable proportion of free butter-fat was obtained from the sterilized sample, while the unsterilized sample yielded only the usual layer of cream. This and the following experiments show, however, that only a small proportion of the fat is freed, and that, on the other hand, the globules not liberated have their envelopes so altered by heat as to lessen their tendency to coalesce:

"*a*. Sterilized and unsterilized portions of milk were churned, and a note made of the time required to form appreciable amounts of butter. The unsterilized portion yielded butter in one-third less time than the sterilized portion.

"*b*. Sterilized and unsterilized milk shaken up with equal parts of ether and petroleum spirit, and allowed to stand for twenty-four hours, showed, by microscopical examination, no obvious variation in the size or condition of the fat-globules.

"III. SUGAR.—Examinations of milk before and after sterilization were made both by polarimetric and reduction methods. It was found that the whey of the unsterilized sample had a dextro-rotatory power appreciably greater than that of the sterilized sample. The actual figures for the amount of sugar solution taken were, for the sterilized sample, 3.47, and for the unsterilized sample, 3.87. These figures were confirmed by duplicate analyses. The comparative reducing power of both

samples on Fehling's solution was, however, but little affected, the slight differences noted being within the limits of experimental error. The exact nature of the change indicated by the polariscope has not been determined.

"The following is an epitome of the ascertained results of sterilization:

"1. Albumin coagulated.

"2. Casein less readily precipitated by rennet than in normal milk. Acid corrects this condition.

"3. Fat is freed to a slight extent; fat not freed has a lessened tendency to coalesce.

"4. Sugar undergoes some change, as shown by its lessened dextro-rotatory power.

"The considerations suggested by a knowledge of the foregoing facts are:

"I. The coagulation of milk-albumin by sterilization may render the milk more difficult of digestion.

"II. Sterilization interferes with the coagulability of milk by rennet, and presumably, therefore, with its digestibility by the gastric juice. [This scarcely agrees with our present ideas. —B. C. H.]

"III. Free fat, as found in sterilized milk, is probably not readily assimilated in infant food. The fat not free, being enclosed in a less-easily destructive envelope, is probably slow of digestion.

"For valuable assistance in conducting these experiments I am greatly indebted to Mr. William Beam. My thanks are also due to Dr. Henry Leffmann for the use of his laboratory, where the experiments were made.

"Eleanor Moore Hiestand, M.D.,
"Demonstrator of Chemistry in the Woman's Medical College of Pennsylvania."

"Philadelphia, December, 1890."

Being sure that the chemical study would bear out the theory in regard to the effect of heat upon the fat-globules and albumin, I adjusted the clinical work to this idea as soon as the chemical investigation had been fairly started. The only way to obviate the action of heat lay obviously in a partial predi-

gestion of the milk and cream; and the only agent at our command to accomplish this result is pancreatin.

The chemical study takes no account of predigested food, as Dr. Hiestand and myself were working independently at the same time, and were ignorant of each other's work till the whole was completed. One of the methods, described in the report, of comparing sterilized with unsterilized milk suggested to me the following idea: If predigestion with pancreatin really affects the fat-globule and makes it easier to free the fat, this action should be demonstrable by the different effects of churning upon predigested milk and cream, and upon sterilized milk and cream. In the first, three minutes' churning of half a tumbler of the mixture produced enough butter more than to fill a teaspoon. The churn used is a small tin affair sold in housefurnishing shops for making whipped cream, which it takes ordinarily about four minutes to do. In the second, less than four minutes' churning of one and one-half ounces produced a good-sized lump of butter. In the third, it took about twelve minutes to form butter at all, and there was not as much by that time as had been produced by four minutes' churning of the predigested sterilized specimen.

There remains to be supplied one more chemical link in the chain of evidence. The stools of children fed upon sterilized and predigested sterilized milk should show a difference in fat contents. We already know that a diet of boiled milk is accompanied by an excess of unassimilated fat in the stools.[1] I should expect to find less unassimilated fat in the stools of infants fed upon predigested sterilized milk than in those fed upon simple sterilized milk. I hope to have this point investigated in the near future, or to learn the truth about it from the work of others.

Still retaining the chemical proportions suggested by Arthur V. Meigs (with the single exception of sugar), and observing the rules for quantity and interval suggested by Snitkin and Holt, the following card was drawn up:

[1] Vasilieff: Thèse inaug., St. Petersburg, 1889.

CARD No. 2.

[Front.]

1. Have ten nursing-bottles prepared clean every morning.
2. Take—

Cream . . . . . 5 ounces.
Milk . . . . . 2½ "

3. Put in skillet; add panereatin powder; heat over alcohol flame for six minutes; stir, and sip constantly; *do not overheat.*
4. Of this mixture, put in each bottle 6 drs. (to make 2-oz. bottle). Use funnel.
5. Add to each bottle 10 drs. sugar solution.
6. Stopper the mouth of each bottle with dry, baked cotton, and sterilize for twenty minutes.
7. Set aside to cool.
8. Before use, put bottle in warming-cup; apply nipple immediately before giving it to infant.

Make sugar solution by dissolving 1 oz. sugar of milk (1 powder) in a pint of warm water.

[Reverse.]

Age.	Interval.	Number of feedings in 24 hours.	Amount of food at each feeding.	Total amount in 24 hours.
1st week	2 hours.	10	1 oz.	10 ozs.
2d to 4th week . . .	2 hours.	9	1½ oz.	13½ ozs.
2d to 3d month . . .	3 hours.	6	3 ozs.	18 ozs.
3d to 4th month . . .	3 hours.	6	4 ozs.	24 ozs.
4th to 5th month . .	3 hours.	6	4–4½ ozs.	24–27 ozs.
6th month	3 hours.	6	5 ozs.	30 ozs.
8th month	3 hours.	6	6 ozs.	36 ozs.
10th month	3 hours.	5	8 ozs.	40 ozs.

The pancreatin powder, for the quantity indicated on the card, consists of

℞.—Pancreatin . . . . . 2½ grains
Bicarbonate of sodium . . . . . 5 "

The sodium salt furnishes the alkalinity desired, so that lime-water may be dispensed with.

The objection urged against the partial predigestion of an infant's food, that, by so doing, one deprives the digestive juices of their natural work, and thereby incurs the risk of atrophy

of the digestive glands, while at first sight forcible, is in reality weak. If, by this method, the food-mixture is reduced to a condition in which there is about as much for the child's digestive powers to do as though it were fed on human milk there is no danger of abrogating any digestive function.

The sugar of milk is prepared in less amounts than would be called for in an exact chemical imitation of human milk. I am not sure that I will not still further reduce the proportion. Although sugar from cow's and human milk is chemically identical, physiologically it cannot be so, for I have often remarked the diuretic properties of lactose from cow's milk when given to an infant, and I have verified the discovery made by others that the lactose of cow's milk can produce a very marked glycosuria in bottle-fed babies.

All the infants in the Philadelphia Hospital during September, October, November, and December that were deprived of their natural nutriment, to the number of twenty-one, were fed after this plan. They were weighed daily and their weight entered upon the weight-sheets which I had printed in the hospital. At first a daily record of their stools was kept, but as none of them became constipated this was not continued. In this connection I must express my thanks to the nurses of the hospital for the faithful manner in which they performed an arduous task.

It will be seen by the tables that four children were under observation less than a week. They will not be considered. The remaining seventeen infants were of all ages under eight months, some of them very young. Of this number eight gained in weight, nine lost. Of the latter number four lost only a slight amount.

Children's Weight-sheet.

These weights are given by weeks, and in pounds and ounces, thus, 7.2 = 7 lbs. 2 ozs.

Name.	Age.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Clarence Wright	2 weeks.	8.6	8½	7.15	8.2	7.14	7.0	6.11								
John Powers	2 "	6.9	6.3½	5.15	6.1	6.3	6.9	5.14	5.13	5.13	5.8					
Walter Jones	3 "	6.15	7.1	6.14	7.2	7.1	7.2	7.9								
Gilbert Burney	6 "	6.04	5.15	6.4	6.2	5.10	5.8									
Clara Lyle	7 "	7.0	7.8													
James Ryan	2 months.	6.12	6.11	6.13	7.0	6.12	6.7½									
Joseph Marianok	2 "	8.0	7.12	7.13	7.12	7.11	7.10	7.2								
George Carpenter	3 "	9.8	9.4													
Elizabeth Bartling	4 "	8.6	8.10	9.0	9.8	9.11	10.2	10.5	10.10	10.15	11.8	12.0	12.5	12.8	12.12	12.14
Joseph Howard	7 "	12 12														
James Lappan	7½ "	11 13	11.15	11.8												
Nellie O'Brien	8 "	10.3	10.1	9.11	9.9	9.14	9.15	9.13	9.8	10.0	10.5	11.2	11.8	11.8	11.12	11.15
John Roth	8 "	9.9	9.3	8.6	8.8	8.5										
John Hamilton	8 "	9.9	9.0	10.3	10.5½	10.0	10.1	10.2	10.1	10.4½						
Nellie Johnson	1 month.	6.13	6.12	7.3	6.15	6.8	6.8	6.13	6.12							
Florence Embers	3 weeks.	5.2½	5.11	5.8	5.8	5.5	5.5									
Annie Harrison	2 hours.	5.9														
Annie Whalen	2 days.	4.13														
Edward Walsh	8 months.	10.8	10.10													
Nellie Fries	4 weeks	3.8½	3.7	0.13												
Lenmon Collins	3 months.	7 4														

Case I.—James Ryan, two months old, lost 4½ ounces in four and one-half weeks. In the first three weeks in the hospital he gained 4 ounces, but in the last twelve days before leaving, during which time he had bronchitis, he lost 8½ ounces.

Case II.—George Carpenter, three months old, lost 4 ounces in one week and a half.

Case III.—J. Lappan, seven and one-half months old, lost 5 ounces in two weeks.

Case IV.—Nellie Johnson, one month old, lost 1 ounce in six weeks. This child gained 9 ounces in the first three weeks, but acquired what was at first thought to be pneumonia, but is now believed to be tuberculosis, with consolidation of the upper part of one lung. During the three weeks of her disease she has lost 10 ounces.

The loss in these four cases was not due to the feeding. In two it was caused by disease, in two others, I think, by the unfavorable hygienic condition in the hospital. The five remaining children died, and naturally lost considerably in the course of their fatal illness. Two of these children were syphilitic, with extensive skin eruptions, and in one of them severe purulent ophthalmia. One died of capillary bronchitis, the other of very severe entero-colitis. This case was especially interesting, for, in spite of the care to sterilize its food, the same symptoms were developed with the same fatal result as though the child had received the worst-infected milk procurable. I believe that in children of miserable development, as in this case, the food, though given sterile, decomposes in the intestinal tract, for it is only reasonable to suppose that, when all other vital functions are performed imperfectly, the digestive juices are insufficient not only to digest food, but even to keep it from rapid putrefaction. The third infant of this series, Gilbert Burney, died of tuberculosis. The whole upper lobe of one lung was consolidated. Of the other two children, one showed a scar of old ulceration in a Peyer's patch, and several fresh ulcers with congestion of the large intestine and disease of a few solitary follicles. This was undoubtedly a case of entero-colitis from food-infection, to be explained, I think, as in one of the syphilitic children. The second infant presented really nothing in the post-mortem examination to account for the death. There was no appre-

ciable entero-colitis, though the mesenteric glands were slightly enlarged. The body was intensely anæmic and very thin. The child appeared simply to waste away.

Of the children who gained in weight, I would direct attention particularly to one, Elizabeth Bartling, aged four months, who gained 4 pounds and 8 ounces in three months and a half, increasing from 8 pounds 6 ounces, to 12 pounds 14 ounces. It is a significant fact that this infant was not in the foundling ward at all, but in a much larger, better-aired room, and in charge of her mother. She was one of twins, one of which was kept on the breast, the other on the bottle. The bottle-fed baby has gained faster than its sister.

I am conscious of much that is imperfect in this clinical study. My material was numerically small. The condition of the infants, many of them picked up on vacant lots, others with parents in the last stages of phthisis, or in the insane department, was in the main very bad, and the environment in the foundling ward of a large hospital is, at the best, unsatisfactory. On one point, however, I am satisfied, namely, that the work of the nurses and resident physicians was earnestly and carefully done. It is on work of this character alone—careful attention to details of feeding and of observation—that a true system of artificial alimentation can be founded. It is a tedious and a troublesome task, but it will amply repay the hardest work—for the discovery of an ideal infant's food, that gives as good results as mother's milk, will do as much to save life and prevent disease as Jenner's discovery, or that of Koch, even if it proves all that is claimed for it.

In conclusion, a few words as to the practical execution of the directions on card No. 2 in private practice—small matters, apparently, but they may mean the difference between failure and success. First, in regard to the sterilization. This is undoubtedly a burden to the child's attendant, which it should be the physician's care to make as light as possible. The best sterilizer, in my opinion, for convenience and efficiency, is the Arnold's steam cooker. It is easy, however, to devise some arrangement, in a family too poor to buy a sterilizer, that will

answer the purpose. As to the bottles, they should be, according to the card, "prepared clean every morning." I have lately seen somewhere the advice to boil the nursing bottles for an hour every day. It reminded me of the excesses committed in the name of antiseptic obstetrics at a time when, in certain hospitals, the child emerged from the vagina under a carbolized spray. It is only necessary to clean the bottles with a strong soda solution and bottle-brush, and then rinse them out well in hot water. They and their contents are made sterile or chemically clean in the sterilizer at the same time. The bottles should be of a form that permits of easy cleansing; as fas as possible from the shapes that are at present most in use. Rotch's bottles are the best in this respect upon the market, but their shape is awkward, and their price precludes the possibility of their general use. A drug firm is at present making for me a feeding-bottle which will have a wide mouth, almost no shoulder, no sharp angles, and shall be of moderate price.

Very careful directions must be given in regard to the predigestion of the milk and cream. The time—six minutes—should be indicated by an open watch before the person who prepares the food; it should never be guesswork. The direction should be given never to let the preparation get hotter than one usually drinks the morning coffee. By the end of six minutes the mixture begins to have a distinctly bitter taste. It always takes a minute or two to distribute the milk and cream among the nursing-bottles; this should be done quickly and everything should be in readiness to begin the sterilization at once, for should the mixture in the skillet remain hot for ten minutes in all, it might be so bitter as to be unfit for use. The steam heat, of course, stops the digestion at once.

It is well worth the trouble, in private practice, to conduct properly the whole procedure once before the child's caretakers.

Finally, the nurse or mother must be told to hold the child in the lap while it is fed and to make it consume some time, about ten minutes, in taking the bottle. This is a matter usually understood, but in some cases it needs the physician's

express attention. In all cases it is essential to success. I was much impressed with the truth of a remark made by a lady, once a trained nurse, now the wife of a distinguished man and herself a mother, who said on a visit to the foundling ward recently, "It is not so much science that these babies need as a mother's coddling."

DISCUSSION.

Dr. H. A. Hare: The possibility of a solution of this subject will depend upon the work of physiological chemists and physiologists who devote themselves to a study of the different substances composing human milk. Two researches have been made in this direction, one by Halliburton, the other by Sydney Ringer, of London. These investigators find that cow's milk, and probably human milk, is made up of a number of albuminous substances. These act differently in respect to the effect of rennet and the acids of the gastric juice. Halliburton believes that cow's milk contains caseinogen, corresponding to fibrinogen, and that from this, by the addition of some ferment not yet isolated, casein is formed. He insists that the term casein should not be applied to all proteid substances found in milk, but simply to the substance made by the addition of rennet to milk. After rennet has caused the caseinogen to change into casein, there still remain a number of albumins, the chief of which are alkali albumin and whey proteid. The former is coagulated by heat, while whey proteid is not coagulated by heat.

Ringer has made a long study of the coagulation of milk. He makes the following statement: that curdled milk is formed by the action of rennet on the caseinogen causing it to change into casein, that this is favored by the presence of sugar of milk, and that it is opposed by the presence of sodium and potassium. It is the function of the sodium and potassium to prevent the clot from becoming hard and dense.

We are apt to analyze milk for the fats and proteids and pay comparatively little attention to the salts. It is evident, from these researches, that the presence of sodium and potassium is of importance in regard to the digestion of the curd. Dr. Hirst has mentioned that the addition of acid causes the rennet to act more rapidly, and the reason for this may be that the acid counteracts the sodium and potassium that are present, and thus promotes the formation of casein. Dr. Hirst mentions a case in which he examined mother's milk and found the casein very low. Corbeau has reported a case where a woman, apparently perfectly healthy, nursed a child for six months. Suddenly the child became ill, and an analysis of the milk showed only traces of casein, the rest of the fluid being made up of fat and the ordinary salts.

EXTRA-UTERINE PREGNANCY, FOLLOWING DILATATION OF THE CERVIX FOR DYSMENORRHŒA AND STERILITY.

Treatment by Electricity: Final Resort to Abdominal Section: Recovery.

By MORRIS J. LEWIS, M.D.

[Read January 7, 1891.]

Mrs. —, twenty-eight years of age. Two members of her family, her sisters, have albuminuria.

As a child, patient enjoyed good health. Menstruation began at usual age, the periods were regular, and the flow normal in amount, but always accompanied by great pain. In 1882 she was married, and shortly after this some operation was performed upon her, which was probably the removal of a rigid hymen and stretching of the vagina, as the latter was said to have been unusually narrow.

A few weeks later a second operation was performed, which was said to have been stretching of the uterine canal, but this is doubtful, as but little pain was caused thereby, and but slight relief followed as far as the dysmenorrhœa was concerned.

The patient was first seen by the writer in 1887. She was still suffering from dysmenorrhœa and complained of symptoms of dyspepsia, although presenting every aspect of health.

In 1888 she began to have a sense of weight and dragging in the lower abdomen, with considerable leucorrhœa. Examination showed that the vagina was normal, that the uterus was in the proper position, but that the vaginal portion was conical, while the os was so small that it would not admit the tip of the uterine sound. An erosion as large as the thumb-nail entirely surrounded the os and there was considerable glairy discharge. Marked discomfort was caused by lifting the uterus on the finger, but no fixation of the organ existed, and there was no ovarian tenderness.

After a few weeks of treatment, which consisted in keeping the bowels

lax, hot douches, and the occasional painting of the vaginal vault with tincture of iodine, conjoined with the internal administration of iron, the leucorrhœa ceased, the erosion healed, and the patient felt well, with the exception of the dysmenorrhœa.

As she had never been pregnant, and was very anxious to become a mother, it seemed that the operation of stretching the uterine canal was indicated, not only for the sterility but also to relieve the dysmenorrhœa.

Dr. Barton C. Hirst was called into consultation, and on November 19, 1889, the patient was etherized and the canal thoroughly stretched a week before the expected menstruation, which appeared at the proper time, November 26th, and was entirely painless. She made a rapid recovery without an unfavorable symptom.

The second menstruation, which was free and accompanied by a good deal of pain, began on December 28th, lasted until January 2, 1890. In the latter part of January there was a third menstruation, but this was so slight that the napkin was barely spotted; a "coffee-colored stain" only.

Early in February she began to have nausea and vomiting, and on the 16th of the month she had slight abdominal pain. An examination on the 17th revealed the fact that the breasts were enlarged and contained colostrum, that the areolæ were darkened and widened, that the glands of Montgomery were developed largely, and that a streak of pigmentation extended from the pubes to the umbilicus.

There was considerable uneasiness in the right inguinal region, which had been present, but to a less degree, for a week; pressure in this neighborhood caused some pain. There was no fever, but the tongue was quite heavily coated, and the bowels were constipated. The patient was given small quantities of calomel and soda every two hours for several doses, and this was followed by a saline. She was told that she was in all probability in the seventh week of pregnancy, dating from the December menstruation. Unfortunately, no vaginal examination was made at this time.

The next day, after a free evacuation of the bowels, she felt much easier, and on the 19th felt sufficiently well to ride some distance to court to appear as a witness. While in court she was seized with a violent pain in the right inguinal region. She almost fainted, and had to be carried home.

When seen by me a short time subsequently she was in a state of shock, but there was no sign of internal hemorrhage. A small tumor could be felt to the right of Douglas's pouch, the neck of the uterus was softened, and the organ pushed somewhat to the left. The diagnosis of probable extra-uterine pregnancy was made, and Dr. Barton C. Hirst again called into consultation. The patient was etherized and examined carefully *per rectum et vaginam*. The cervix was found softened, the uterus anteflexed and pushed to the left-hand side. A tumor could be felt in the position of the right broad ligament, of the shape and direction of the tube, and apparently as large as a lemon. The diagnosis of extra-uterine pregnancy (of the tubal variety) was verified.

It was decided to use electricity as the treatment and to watch for any sign of internal hemorrhage. All arrangements for abdominal section were made, in case this procedure should be deemed necessary. Dr. G. Betton Massey was called in to attend to the electrical treatment, which was carried out as follows:

Notes of electrical treatment made by Dr. Massey: "*February* 20. Examination showed a tender mass to right of uterus. Vaginal negative galvanic application, 100 milliampères for eight minutes, inclusive of increase. External electrode on abdomen over tumor and internal pressed against mass. Temperature at this time 100° F.

"21*st*. Vaginal faradic, total strength of Flemming's No. 3 battery, for eight minutes, electrodes as before. Temperature normal.

"22*d*. Galvanic, as before, 100 milliampères for five minutes, slight discharge. Temperature normal.

"23*d*. Faradic, as before, eight minutes—mass freer and more easily defined. Temperature normal.

"24*th*. Galvanic, as before. 100 milliampères for five minutes.

"25*th*. Faradic, as before, for eight minutes."

After the third day of electrical treatment there was a considerable amount of watery fluid discharged. This was examined upon the napkin, and thought to be liquor amnii. The tumor at this time became sensibly smaller.

After the sixth day of electrical treatment it was found that the uterus was enlarging, and it was feared that there might be a mistake in the diagnosis, and the case after all have been one of uterine pregnancy with an accompanying tubal trouble. The electricity was therefore suspended, and all present were unanimous as to the uselessness of further treatment in this direction, considering that if the end hoped for (viz., the destruction of the vitality of the fœtus) was not already attained, that electricity had failed as a method of treatment for this condition. No marked discomfort was caused by this treatment except during the passage of the current, and even then this was perfectly bearable.

The urine, which previously to the pregnancy had been normal, presented on February 23d the following condition: Amount in twenty-four hours, twenty-eight fluid ounces. Albumin in considerable quantity. Microscopic examination revealed numerous pus-corpuscles, and several granular and hyaline casts. One week later no albumin could be detected, although on March 3d it was found again with a reappearance of pus, but no cast could be discovered; the specific gravity was 1030. Subsequent examination showed that the urine had become normal.

From the 27th of February to the 5th of March was a period during which decidua were passing; every napkin and every particle of decidua was carefully examined, and no evidence of fœtal tissue was found. A microscopic examination of the material passed confirmed this view.

On March 8th the following note was made by Dr. Hirst: "Uterus in

middle line, firm, about the normal size, almost normally movable. Tenderness at right cornua. A small tumor to right of Douglas's pouch, size of an English walnut. (Ovary?) tender and adherent."

The treatment up to this time, exclusive of the electricity, had been mainly expectant. The diet was plain, and the bowels were kept open by Epsom salts in small doses. On March 9th she was allowed to sit up for the first time, and on March 15th the following note was made: "Uterus quite normal. In right broad ligament and to the right of Douglas's pouch there is an exaggerated sense of resistance, as from hardening exudate, or organizing blood-clot. Condition otherwise normal." The patient continued to improve, and was up for a longer and longer period daily, but during this time she could not bear anything tight around her waist, and complained of a slight sense of dragging in the lower part of her abdomen.

On April 3d a scanty bloody flow appeared, which ceased in the evening, and began again on the morning of the 4th, to cease again in a short time. On this morning, while sitting upon the chamber to urinate, she felt as if something had suddenly ruptured in her pelvis; this was accompanied by slight pain, and followed by all the symptoms of internal hemorrhage. Examination an hour later revealed a large tumor occupying the position of the former small mass, pushing the uterus far to the left and bulging the vault of the vagina downward on the right side of the uterus almost to a level with the os; behind the uterus in Douglas's pouch there was no bulging or evidence of fluid. The tumor did not reach its full size at once, but occupied several hours in doing so. Ergot and other means of checking hemorrhage were employed. The diagnosis of hæmatoma into the right lateral ligament, and probably confined to this, was made.

On the 5th there was a repetition of the sensation of yielding in the pelvis, and examination revealed a slight change in the shape of the mass; there was now a comma-shaped process extending behind the cervix. The temperature during these two days was over 100°. A slight yellowish discharge now appeared, and strong pulsation could be felt in the artery traversing the right wall of the vagina. After this increase in the area of the mass the tension appeared to be somewhat diminished, and the bulging less prominent. Examination caused no pain. There was no increased swelling of the abdomen, but the rigid condition of the recti muscles precluded any careful diagnosis by palpation.

On the 7th a slight flow of blood again appeared, and a tendency for the tumor to extend in front of the cervix was noted. The mass began to feel as if it were solidifying. From the 14th to the 18th there was a considerable flow of blood, with the passage again of masses resembling decidua. This was accompanied by some uterine colic. The tumor had now retracted above the level of the cervix; the cervix was retracted and softened and the os patulous.

On May 1st the tumor was noted as one-half of the original size; the

uterus was well anteverted, and still pushed somewhat to the left; the cervix was almost natural in consistence, and the os slightly patulous. The flow of blood, which had started again on April 28th, ceased at this time, ergot having been taken since the 19th. Examination was absolutely painless. The artery in the vaginal wall still pulsated strongly.

On May 8th she was sitting up again. On the 16th, after a day of irritability, a free flow of blood again appeared.

Note by Dr. Hirst made at this time: "Mass is deeper in pelvis than before, and uterus is again pushed more to the left. The tumor is irregular, and of different consistency in its different parts; an indistinct sense of resistance can be felt above pubes, but no mass can be detected in abdomen."

On the 21st, five days later, a mass extending up as far as the umbilicus

FIG. 1.

Left ovary and tube, showing parovarian cyst.

in the middle line was detected for the first time, although almost daily examinations had been made. The abdominal muscles at this time were much less resistant.

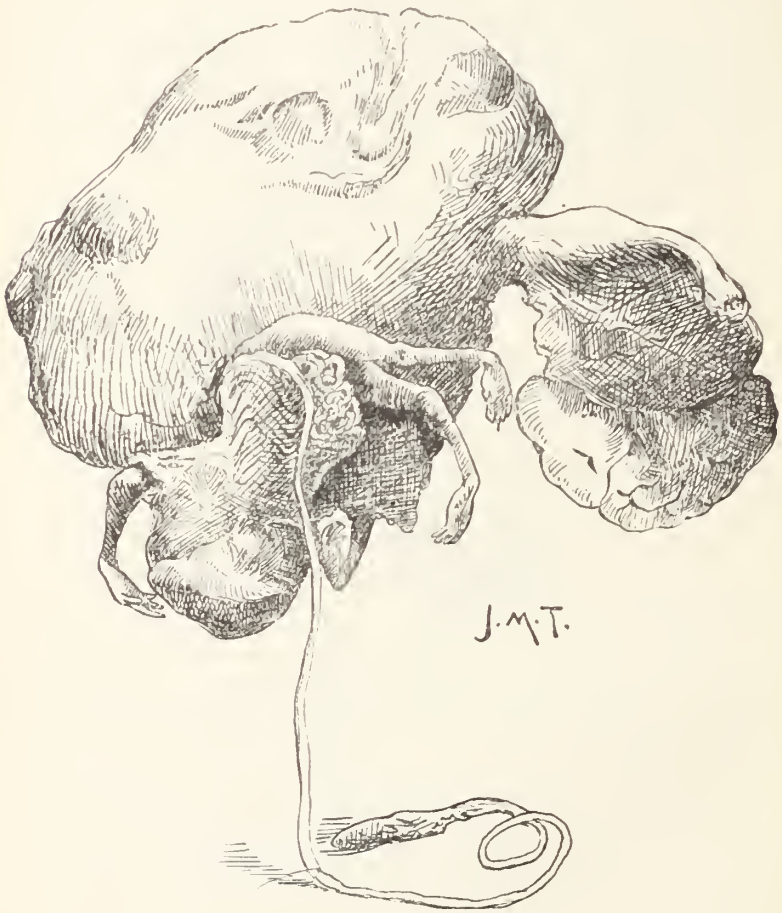
On account of the uncertainty of the pathological condition present, abdominal section was advised, and at once consented to. This was performed on May 23d by Dr. Charles B. Penrose. I will leave the description of the operation to Dr. Penrose, merely giving the pathological conditions found.

Considerable peritoneal adhesions were encountered upon both sides of the abdomen. On the right side, in the position of the tube, a large mass could be felt; the intestines were adherent to this by comparatively firm bands of lymph, and in separating them the wall of the tumor was ruptured, with the consequent escape of firm clots of blood, partly organized. After removing a quantity of these clots, sufficient when aggregated to form a

mass as large as a small shaddock, it was possible to enucleate the sac and to remove it together with the right ovary.

Adhesions were also found upon the left side, the ovary was slightly smaller than its fellow on the right, the fimbriated extremity of the tube was firmly bound down to the gland, and springing from the posterior and

Fig. 2.



upper portion was a cyst as large as an English walnut, and filled with clear fluid; these structures on the left side were then removed (Fig. 1).

In examining the clots of blood removed from the right side, the fœtus was found after some search; it had evidently been dead for some time. It measured three and one-half inches in length, its fingers and toes were

well formed and separated—the nails being plainly seen. The genital organs were visible. These and other points render it certain that the fœtus was at least three months old when it died.

The head had collapsed and contained no brains. From the occiput to the dorsal region, and from shoulder to shoulder, the back was broadened out and concave, and presented the same appearance as the inside of the sac at its anterior lower and outer aspect—this will be alluded to further on.

The sac was entire, although torn in several places, and was placed with the fœtus into alcohol for further examination.

After hardening in alcohol for several months, and after carefully sewing together the rents which were made on its removal, the sac measures three and one-half inches long, two inches wide, and two and one-half inches deep; it occupies the distal extremity of the tube, which suddenly enlarges as it becomes the sac. A ragged opening exists at the anterior lower and outer portion, into which the area upon the back of the fœtus, previously mentioned, accurately fits. (See Fig. 2.)

It will thus be seen that the major portion of the fœtus was entirely outside of the sac, and was apparently covered by coagulated blood, which was strictly confined to the locality of the effusion.

The cyst evidently ruptured April 4th, the date of her second attack; the fœtus being thereby killed and partly extruded into the abdominal cavity, closing the opening in the sac by its body. The inflammatory processes subsequently occurring formed a new sac, so to speak, including the fœtus as part of its walls. The placenta was not found. The blood, as effused, was not free to move in the abdominal cavity, but was confined as just mentioned; there was none in Douglas's pouch.

Remarks.—I have reported this case fully on account of its extreme interest, so many of the facts being known, making it an important case in the history of the treatment of extra-uterine pregnancy.

Considerable interest has been manifested in the case by members of the medical profession, and it has even been partially reported by those who only know of the case by hearsay.

A point in the etiology of the case seems worthy of note, viz., the possibility of there having been a faulty development of the generative organs. The external genitals being small, the vagina narrow, and the uterine canal needing dilatation, make it one of the possibilities that the tubes may also have been malformed, impeding the free passage of the impregnated ovum to the uterus, and thus predisposing to tubal pregnancy.

It seems almost certain that impregnation took place at the December menstruation, and not at the period following the operation, viz., November 26th. The menstruation late in January being merely a show, a few drops literally, does not diminish the probability of pregnancy existing at the time. The other facts, also, fit in with this theory. Therefore, when the first accident happened on February 19th, the patient was about seven weeks pregnant, the size of the tumor agreeing with this period of gestation.

Electricity was applied for six days, from February 20th to 26th, inclusive, and evidently had no effect whatever in destroying the vitality of the fœtus, or even of retarding its development, as I think I can clearly demonstrate.

The fœtus, as removed at the operation, had evidently been dead for some time, and must have been at least three months old, if not older, when it died. The electricity could not, therefore, have had anything to do with its death, as it was applied seven weeks after impregnation.

It might possibly be argued that the patient had conceived immediately after the stretching, but from the clear history given, this is almost, if not quite, impossible, and although on this theory the fœtus would have been three months old, the size of the tumor, viz., that of a lemon, and clearly defined, would not have been that of that period of gestation.

Admitting, for the sake of argument, that the vitality of the fœtus was destroyed by the electrical treatment at the age of three months, the susequent hæmatocele was not prevented by it, and this methed of treatment, in this case, therefore, proved to be useless. The date of the second accident, viz., the appearance of the hæmatocele, April 3d, being just thirteen weeks after the time of the supposed conception, renders it almost certain that this was the cause of the fœtal death.

It cannot be said that the electricity was not properly applied, or kept up for a sufficient length of time: for if the daily application of this agent for six days, galvanic and faradic currents alternating, in quantities as strong as dared be given,

and in the hands of one competent to apply it, was not sufficient to destroy the vitality of the fœtus, surely it is an agent that cannot be trusted in such cases.

It cannot be argued that any growth or malformation of the parts hindered the electrical application, as the tumor was easily reached by the vaginal electrode; in other words, this case was as typical a case as the advocates of electricity could wish for, to prove the efficacy of their treatment.

It was thought at the time that the diminution in the size of the tumor after this treatment, and the escape of what was apparently liquor amnii, indicated the death of the fœtus and a favorable termination.

The rigidity of the abdominal walls, in the later history of the case, was evidently the cause of our not detecting the large mass in the abdomen until late in May, and the position occupied by the tumor, viz., behind the uterus, prevented us from detecting it *per vaginam*. Witness the note made May 16th.

We considered the hæmatocele was doing little harm, the temperature was normal, and there was no evidence of suppuration or of further bleeding.

During the whole of the case, we were ready upon a moment's notice, to perform abdominal section, should any more serious symptom arise, and a trained and experienced nurse was, with the exception of twelve days, from March 21st to April 3d, constantly in attendance.

The reasons for selecting the method of treatment employed were the early period of the pregnancy, and the fact that the case seemed a most typical one on which to use electricity, inasmuch as this procedure is reported by good authorities to have succeeded.

The family was informed, as previously stated, of the possibility of failure and of the necessity of having recourse to surgical interference at any time.

The subsequent course of the case, before the occurrence of the hæmatocele, seemed to justify the method of treatment employed; the hemorrhage being ascribed to the rupture of a vein in the neighborhood of the sac into the broad ligament,

induced by the approaching menstrual period and aggravated by allowing the patient to sit up too soon.

The first accident could not have been a serious one, and but little, if any, blood could have escaped; but some local peritonitis was evidently set up at that time.

An interesting question arises in regard to the causation of the condition of the left ovary and tube. No sign of salpingitis followed the stretching, and there was certainly none of peritonitis. During her illness the patient constantly complained of pain in the left ovarian region, but as this was always accompanied by flatus, and diminished or disappeared on its escape, it was mainly ascribed to this cause. The question also arises in my mind, whether an early operation would have saved the patient the loss of the left ovary, but this is merely a matter of conjecture, and cannot be settled. It is, therefore, useless to discuss it. The cyst upon this side possibly antedated the extra-uterine pregnancy.

At the operation it was a disappointment to me to find this disease on the left side, but as it was seen that the patient was dangerously sterile, while the operation rendered her harmlessly so, it was decided to remove it. Although it may be claimed that the case was undergoing spontaneous cure and ultimately would have recovered without surgical interference, still I regret that the operation was not done at an earlier date, thus saving the patient needless suffering and worry.

I do not profess to be a gynecologist, but this case convinces me of the worse than utter uselessness of using electricity in extra-uterine pregnancy, and the great danger and responsibility of delaying the radical operation for relief. It also emphasizes the difficulty of diagnosticating conditions within the abdomen.

The patient at the time of writing this account, December, 1890, is enjoying excellent health, and looks younger and better than I have ever seen her.

DETAILS OF THE OPERATION IN DR. LEWIS'S CASE OF ECTOPIC PREGNANCY.

By CHARLES B. PENROSE, M.D.

[Read January 7, 1891.]

As Dr. Lewis has said, laparotomy was performed on May 23, 1890:

A three-inch incision was made in the median line, terminating immediately above the pubis. The omentum and intestines were found somewhat adherent to the pelvic contents—to the uterus, the right and left broad ligament, and to the left ovary.

To the right of the uterus, and covered by the posterior layer of peritoneum of the right broad ligament, and bulging backward into Douglas's pouch, was a cyst filled with blood-clot in various stages of retrograde change. The cyst was about the size of a large fœtal head, and extended downward to the base of the broad ligament. The cyst wall was very friable and broke during removal. The contained blood-clot escaped into the abdomen, and was removed with the hand. The fœtus was taken out along with a handful of clot, but was not recognized until out of the abdomen.

The cyst was freed from its adhesions and attachments until a suitable pedicle was obtained, when the tube, ovary, and cyst were ligated and removed. There was free bleeding during this operation, which was entirely checked as soon as the pedicle was tied.

The left appendages were next removed.

The left Fallopian tube was closed and somewhat distended and adherent to the ovary. There was a small parovarian cyst about the size of an English walnut. The left ovary was adherent to the sigmoid flexure.

The lower part of the abdomen and pelvis was then freely irrigated with four gallons of hot distilled water. During this irrigation much blood-clot and débris were washed out. The placenta was not found. It was probably lost among the clots washed from the abdomen. The abdomen was drained with a glass tube. Recovery was uninterrupted. The drainage-tube was removed on the second day. The temperature remained practically normal, and the patient was able to sit up twenty-four days after the operation.

There are two operative points to which I take the liberty of asking your attention. One is the ease with which the hemorrhage is controlled in these eases by ligating the broad ligament. If everything is removed quickly, and no time wasted in attempting to stop hemorrhage until a pedicle is obtained, all bleeding can be controlled by the one ligature. Several cases have been lost by neglect of this rule.

The second point is the value of free irrigation of the abdomen, which was well illustrated by this case. It would have been impossible in any other way completely to remove all the blood-clot and débris.

This case presents many points of interest which have been referred to by Dr. Lewis. In the first place, with regard to the cause of the ectopic pregnancy. I do not think that the faulty development of the generative organs had anything to do with this. For this faulty development did not extend above the cervix. The vagina was narrow, and the uterine canal needed dilatation; but the uterus itself was normal in size, shape, and position, and tubes and ovaries were normally developed.

I think that the disease which brought about the condition of the left tube and ovary, shown by the specimen and picture, was also the predisposing cause of the ectopic pregnancy. The salpingitis, or inflammation, which caused agglutination of the fimbriæ of the tube to the surface of the ovary on the left side, in all probability, destroyed the cilia of the epithelium of the right tube, or so interfered with their motion that the passage of the ovum along the tube was retarded, and no impediment was offered to the ingress of the spermatozoa.

It is possible that the narrow cervix, by obstructing the menstrual flow, or perhaps the first dilatation, may have been the cause of this salpingitis. The fact that there had been some inflammatory trouble before the patient came under Dr. Lewis's care, was shown by the discharge from, and the erosion around, the cervix.

Another point of interest is the diagnosis of ectopic pregnancy, which was made before rupture of the tube. For I do

not think that the first attack of pain which this woman had when in court on February 19th—over six weeks after conception—was caused by rupture of the tube.

On this occasion there were no signs of internal hemorrhage, and the shape and size and position of the tumor, felt a very few hours after this attack, were not characteristic of extra-peritoneal hæmatocele, or of effusion of blood into the broad ligament. Dr. Lewis states explicitly that a tumor could be felt to the right of the uterus, of the shape and direction of the tube, and apparently as large as a lemon. I think that this attack was one to which all women in the early weeks of ectopic pregnancy are liable, and was caused by partial separation of the placenta from the walls of the tube, with resulting slight hemorrhage into, and distention of, the tube, without sufficient tension for rupture; and I think that the pelvic examination proves that this was the case. The real tubal rupture took place on the 3d of April, twelve weeks after conception. This attack was accompanied with all the symptoms of internal hemorrhage; and pelvic examination showed a large tumor occupying the position of the former small mass, pushing the uterus to the left and bulging the vault of the vagina downward on the right to the level of the os, and this tumor did not reach its full size at once, but occupied several hours in doing so. These were the characteristic signs of extra-peritoneal hæmatocele, resulting from rupture of the tube into the broad ligament. It was this accident which caused the death of the fœtus. If this view is true, this case becomes of especial interest, because the diagnosis was made before primary rupture of the tube. The history of reported cases of ectopic gestation shows that such a diagnosis is very rarely possible; because the symptoms of ectopic pregnancy, if present at all, are so few and so indefinite during the early weeks that the woman never seeks medical advice until rupture has taken place.

The case under discussion, however, was unusually easy to diagnose. The woman followed the general rule, of a previous long period of sterility. From the beginning she presented

not only all the usual signs of pregnancy, cessation of menses, nausea, mammary changes, etc., but, even at a very early period, certain signs which pointed toward right tubal pregnancy, as uneasiness, pain, and tenderness in the right ovarian region—symptoms which were present only five weeks after conception took place. Then, finally, the increased pain necessitated a pelvic examination, which revealed her condition when only seven weeks pregnant. It is very unfortunate that we do not always have such a typical case for diagnosis.

The next point is the early treatment.

The woman was seven weeks gone with a fœtus in the right Fallopian tube when her condition was diagnosed. The history of these cases shows that, some time before the fourteenth week, the tube ruptures, always with one of two results. It may rupture into the peritoneum, in which case the woman always dies, unless relieved by immediate laparotomy; or it may rupture between the folds of the broad ligament. Such a rupture is not immediately fatal, but may become so by secondary rupture into the peritoneum, or by the death and decomposition of the fœtus and suppuration of the cyst contents, with the formation of a pelvic abscess, its burrowing and its sinuses and sequelæ, which are so familiar to all of us.

The two plans of treatment open, were to remove the tube and its contents, and avoid these dangers, by laparotomy; or to try to kill the fœtus by electricity, stop further distention of the tube, and trust to nature for absorption. Aside from all other arguments which can be made and have been made against the use of electricity in the treatment of ectopic pregnancy, I think that the fact that electricity failed to kill the fœtus in this case, with everything in its favor, and manipulated by an expert, shows that it is worse than waste of time to trifle with this agent in such cases.

That electricity did fail to kill the fœtus is proved by the fact that it continued to grow for over six weeks after the use of electricity, and was finally killed by rupture of the tube when twelve weeks old.

With regard to the disease of the left tube and ovary, as I

have already said, I think that it existed before conception; and the inflammatory trouble which caused it also caused the ectopic pregnancy. The pain in the left ovarian region, of which she complained during her illness, and which was generally accompanied by flatus and relieved by its escape, can easily be accounted for by the adhesion existing between the ovary and sigmoid flexure.

There were two occasions in the history of this case when the advisability of laparotomy was considered. One was after the first attack of pain when the presence of ectopic pregnancy was discovered. I think, and Dr. Lewis agrees with me, that laparotomy should have been immediately performed, to save the patient from all the dangers of her condition—the chief of which was intra-peritoneal rupture. With such a danger imminent, the life of the fœtus should be of no consideration. The operation itself would have been simple, with a mortality of under five per cent., and the woman would have received only benefit by the removal of a dangerous and useless appendage.

The second occasion was after extra-peritoneal rupture, or rupture into the broad ligament, had taken place. After this the risk of secondary intra-peritoneal rupture was not so great. This danger, however, was constantly present, accompanied by all the dangers attending the formation of a pelvic abscess.

Laparotomy was indicated here as it would be in any case of pelvic tumor; and especially so, as Dr. Lewis has said, since the pathological condition was uncertain, and disease of the tube and ovary was also diagnosed upon the left side.

DISCUSSION.

Dr. William Goodell: There is little to be added to what has already been said so well in Dr. Penrose's paper. While willing to grant Dr. Lewis that in one sense his was a diagnosis made before rupture, yet it was a diagnosis based upon the symptoms of rupture, caused by the over-distention and possibly fissuring of the walls of the tube, and it, therefore, fails as a crucial diagnosis. In regard to electricity, I am getting more and more out of conceit with it. There are a number of objections to it. In the first place,

it is very untrustworthy in its action, for, while cases have been reported in which the fœtus has been killed, there are probably as many in which the ovum was not destroyed. In the second place, I look upon it as far more dangerous than the knife, in so far as life is concerned. In the third place, it leaves the patient with diseased tubes and damaged ovaries, and with all the dangers and discomforts which attend such lesions. Hence, at some future time, she may have to be operated on for ovarian adhesions or for pyosalpinx or other tubal disease. In the fourth place, the placenta may go on growing after the death of the child. There have been a number of well-attested cases in which the fœtus has perished, but the placenta has continued to grow so rapidly as to burst the tube which contained it. While I decidedly object to the use of electricity in these cases, and contend that it cannot for a moment compete with laparotomy, yet an unskilled physician can do less harm with the former than with the knife; and it would, therefore, be wiser for him to resort to electricity, provided he could not summon a specialist to his aid.

I agree that the operation should have been done earlier; but I do not share with Dr. Lewis his surprise in finding the left tube diseased. I have had a large number of cases of extra-uterine fœtation, and I have almost invariably found both tubes diseased and almost as often both ovaries. It is the catarrh of the tube that causes the extra-uterine fœtation; for it either denudes the tube of cilia or contracts it at various points. If the cilia are wanting, the spermatozoa, by virtue of their own inherent motion, are able to pass up the tube and reach the ovum, but the passive impregnated ovum cannot descend into the womb, and, therefore, remains in the tube. Or we may have a constriction of the tube, which, while it permits the small spermatozoa to pass up, will not allow the larger ovum to descend. In almost every case I have been obliged to remove the other ovary and tube on account of their diseased condition. I say almost every case, because in some cases the amount of destruction, adhesion, and matting together has been so great that it has been impossible for me to discover the other ovary and tube.

I fully agree with Dr. Penrose in regard to the utility of irrigation. It is impossible to cleanse the abdominal cavity without it. In two instances I have washed out the little fœtus which otherwise would not have been found.

The only criticism that I can make is, that the operation should have been done earlier, not to prevent disease of the left ovary, which probably already existed, but to spare the woman the dangers which delay augments.

One of the several cases that has helped to put me out of conceit with electricity, was that of a colored woman whom I was called to see two weeks ago. She had a large uterine fibroid, on which electrolysis had been tried by a gentleman well versed in its use. This was followed by an exceedingly

severe attack of septic peritonitis. When I saw her with the two attending physicians, my opinion was that she would die during the night, but she managed to pull through and is now improving. This was the result of a mild intra-uterine application of electricity.

Dr. Edward L. Duer: Reference has been made to the etiology of the condition of the left ovary. There is no question in my mind that the left ovary was, in all probability, in the condition at the time of conception in which it was found at the operation. The inflammation and effusion of blood on the right side had, I think, nothing to do with the state of the left ovary.

The etiology of these cases of extra-uterine pregnancy is of interest. The point as to the possibility of faulty development of the tube seems to be well taken. Wherever we have a conical os we are apt to have other trouble. However much the os be dilated, we often find that women fail to conceive. The impregnation doubtless took place immediately after the painful menstruation, completed in the early part of January. The pregnancy must have occurred immediately after that or immediately before the succeeding period. If impregnation was effected immediately before the succeeding one, of course the fœtus was much younger, and electricity had a better opportunity to destroy its life. It seems to me that electricity was manifestly a failure in this instance. These are most important cases at the present time when the value of electricity is *sub judice*, and every one who has such a case should report it.

Dr. G. Betton Massey: I must admit, with Dr. Goodell and Dr. Lewis, that electricity seems to have been a failure in this case in a certain sense. It did not prevent the formation of a hæmatoma two months subsequent to the application of electricity. I cannot, however, agree with Dr. Lewis in regard to the date of the death of the fœtus. I have here a copy of his paper, and the notes made subsequent to the electrical treatment and before the formation of the hæmatoma were as follows: "March 8th, examination by Dr. Hirst: Uterus in the middle line, firm, about normal size, and almost normally movable. Tenderness at the right cornua. A small tumor to the right of Douglas's pouch the size of an English walnut. Ovary (?) tender and adherent." I cannot think that there was a growing fœtus at the time that note was made. The size of the tumor at that time would correspond closely to the size of the fœtus without the addition of the augmented circulation of a living ovum. On the 15th another note was made: "Uterus quite normal. In the right broad ligament, and to the right of Douglas's pouch, there is an exaggerated sense of resistance, as from hardening exudate or organizing blood-clot. The condition otherwise normal." I do not think that these two notes, coupled with the comfortable condition of the patient, who was only kept in bed by the carefulness of her attendant, are consistent with the idea of a growing pregnancy.

I think that the pregnancy must have begun a month earlier than sus-

peeted, occurring after the stretching in November, the patient having had a painless period followed by a painful one in December. We have no clear history of this one, and we do not know whether it was free or not. The third menstrual period, which occurred about January 1st, is admitted by Dr. Lewis to have appeared during the existence of pregnancy, and was but slight.

While, therefore, this case is quite a blow to those who have argued in favor of electricity in this condition, of whom I do not count myself very prominent, it does not take away from these physicians the hope that electricity may kill the fœtus. I think that it killed the fœtus in this case, although it did not prevent the occurrence of hemorrhage, which might have been due to the growing placenta, as mentioned by Dr. Goodell. This opinion, however, may be an over-cautious one, for we have here simply an extravasation of pure blood, which, like the fœtus itself, was undergoing a spontaneous cure by absorption.

Dr. J. Price: There are some points that I should like to discuss briefly, although I cannot enter fully into an analysis of the diagnosis and procrastination practised in this case. Dr. Massey's point is well taken in regard to the behavior of this particular case, the character of the rupture, and the period of conception. It is my impression, purely from a clinical standpoint, that the fœtus was dead and discharged when the woman left the court-room. I can prove this from an analysis of this, and a citation of many similar cases. I will allude briefly to two points: First, the character of the presenting body. It was for a long time the size of an English walnut, on the right side only, and they tell us no evidence of mischief on the left. Mark that the mass on the left side as large as an English walnut was never recognized. This woman had a paroxysm of atrocious pain and swooned in the court-room, was carried home unconscious and treated for shock. Evidences of mischief on the right side were found about the right broad ligament. That is about as far as any one dealing with these cases would go. The so-called shock in these cases is not shock, it is hemorrhage.

In regard to the multiple nature of troubles in the pelvis, Sutton, Bantock, Barnes, Tait, myself, and many others, have removed ectopic pregnancies from one side, and small ovarian cysts, pus tubes, and so forth from the opposite side.

In my experience of fifty-three sections for ectopic pregnancy, I have never found hæmatoma, so-called, in the leaflets of the peritoneum, the so-called broad ligament. In short, with no small experience in pelvic troubles, I have never found the so-called hæmatocele, about which we read in the books. The crest of the leaflets forming the broad ligament is a very small portion of the base of the tube—less than a line in the healthy condition—and there is a peculiar formation of the tube, which I cannot discuss here, which favors rupture at other points than this well-defined crest. I simply allude to this in connection with the statement that I have never found retro-peritoneal and sub-peritoneal, so-called extra-peritoneal hæmatocele.

America has an inheritance in prompt, skilful work in ectopic pregnancy. Dr. William Baynham, of Virginia, was the first man to perform abdominal section for ectopic pregnancy after a rational, deliberate diagnosis. This he did, Mr. President, just one century ago, January 14, 1791; the subject of this first operation being a Mrs. Cocke, the wife of a Virginia planter. He repeated the operation, in 1799, upon a negro slave. The occurrence of these two cases in such close proximity, emphasizes the frequency of the trouble, occurring, as they did, in a thickly settled community. The honor of having been the first to perform abdominal section for ectopic pregnancy in a methodical manner, after a diagnosis, cannot be denied to Baynham, any more than ovariotomy can to McDowell. Curiously again, both of these operations antedated McDowell's first ovariotomy, which was done in 1809. Both these fathers were born in Virginia. The operation is now established and has become exceedingly common. Scarcely a week passes without my receiving letters from physicians telling about operations or asking in regard to the propriety of operating. Many good men throughout the country have learned to recognize the nature of the trouble and the importance of prompt surgery. In the light of our present knowledge it is most culpable to permit a patient to suffer and die without an early effort to save her life. Again, it is thrice dangerous to advise patients to wait for complications or hemorrhages, and to resort to tinkering and delay, before using sure and positive methods. In short, all other methods jeopardize life and have nothing in their history to recommend them. The history of most cases is uncertain, "primary rupture and hemorrhage," recurring "hemorrhage," is the story. About all deaths are due to hemorrhage, not to shock; and the results of inflammation and suppuration of the gestation sac place the patient's life in such jeopardy as to demand prompt removal in all cases. Experience has shown that surgery gives the best results, both in the primary and secondary conditions. I have done fifty-three sections for ectopic pregnancy, with two deaths. One of the deaths, I think, could be excluded, for the woman died on the commode, after moving around, in the third week.

It is interesting to compare the results of the surgeon with the work of the pathologist and coroner's physician. In Mr. Hutchinson's collection of 102 cases, in 21 the fœtus remained quiescent throughout life, in 13 the irritation led to the death of the mother. In some the mother died during spurious labor. Most cases that go to term die of spurious labor. In other instances peritonitis followed on the death of the fœtus. In 29 cases the fœtus was discharged piecemeal through suppurating openings in the abdominal wall. In 23 cases the disintegrated fœtus was discharged by suppuration through the bladder and rectum.

Dr. J. M. Baldy: I cannot agree with either Dr. Price or Dr. Massey as to the time of the death of the fœtus. The woman menstruated November 26th, immediately following the dilatation. She menstruated again on

December 28th, the period being full and free, lasting five days. She next menstruated on January 28th, and this menstruation was scanty. There is no question that the woman conceived after the December menstruation. The history of these ectopic cases is that they have no menstruation, or a scanty one following the conception. Such is the history of this case. Electricity was applied seven weeks later, dating from the December menstruation, which was normal. If the fœtus was killed by the electricity, the operation should have shown a seven weeks' fœtus. The operation shows a fœtus of three months' development and consequently the fœtus could not have died at the time these gentlemen claim.

The clinical fact against rupture having occurred, as Dr. Price thinks, when the woman was in the court-room, February 19th, is that at that time there was no local condition indicating hæmatocele. On the contrary, when the true rupture did occur, April 2d, which led to the operation, there were all the local conditions of hæmatocele. If the rupture did not occur in the court-room, how then explain her violent symptoms? I have operated in such a case with just such severe symptoms, in fact, where they had been repeated, and removed an unruptured tubal pregnancy. So, whatever the cause of the pain and shock, the plain fact remains that they do occur without rupture. I, therefore, cannot admit that the fœtus died before the real rupture, which occurred April 2d.

Dr. Goodell's views coincide so thoroughly with my own that I will merely support some of his general statements by a few specific facts. There is undeniable uncertainty of electricity killing a given fœtus. This is not at all theoretical. The case presented to-night is probably the most remarkable on record. There have been many others reported. Dr. Coe, of New York, reports a case which had been treated for two or three weeks by electricity by a skilled physician, in which the fœtus continued to grow, and the patient went from bad to worse, until, finally, an operation was done, and a living fœtus was found—it is true it was intra-uterine—but, nevertheless, electricity had failed to kill it. Buckmaster put a patient under ether, and passed electricity through a fibroid uterus, using the galvanic current for twenty minutes, but the fœtus went on developing, and was delivered at term. Wylie had a case in which electricity was passed with the object of killing the fœtus. It failed utterly. The sac was finally injected with morphia. This succeeded in killing the fœtus and the patient died. Bovee had a patient pass through his hands who had formerly been a patient of Chadwick. Chadwick thought that he had killed the extra-uterine fœtus at the eleventh week. Bovee afterward removed a five months' fœtus from the rectum or vagina. Tuttle had a case two weeks under electrical treatment with the object of killing the fœtus. It failed, and finally abdominal section was required. Here we have without much search of the literature at least six cases showing the utter failure of electricity.

If this uncertainty were the only thing against electricity it would not be quite so bad. To apply the electrical treatment we have to take time into consideration, from a few days to a few weeks. This question of delay means great danger to the patient. Cases of ectopic pregnancy may rupture anywhere from three weeks to three months. It may seem theoretical to say that there is danger in the delay of a few days or a week, but there are cases in which accidents have happened from delay. Thomas had a patient brought to his office for diagnosis and advice. He sent her home with the advice to try electricity. The sac ruptured while on her way home. Montgomery had a case in which rupture occurred while the electrical treatment was being applied, and I assisted him with the operation. Coe had a case which ruptured while electricity was being applied. Formad and Englemann have both reported cases where rupture took place as early as the third week. Formad has made autopsies on some thirty cases wherein death took place without any diagnosis being made.

Not only is there danger in delay, but there is danger in the treatment by electricity. Brothers, who is an ardent advocate of electricity, has collected fifty cases treated by it, many of which, however, I conceive were not extra-uterine. Of this number, four cases presented alarming symptoms during treatment. Coe had a case in which the patient became so sick that abdominal section was necessitated. Montgomery's case has been mentioned. Jauvrin had a case die shortly after the application of electricity.

In addition to this, there is danger to the mother after the electrical treatment is over, even granting that the fœtus had been killed. Brothers has reported two cases in which the fœtus was killed by electricity, but was discharged by suppuration. J. P. Tuttle delivered a fœtus by the rectum, after it was killed by electricity. G. M. Tuttle reports a case which contined to grow steadily worse. There are many cases, not treated by electricity, where the fœtus has died, and in which suppuration has occurred, and the bones of the fœtus been discharged by various channels.

Of Brothers's 50 collected cases, there were 15 with tumors, from the size of an egg to the size of the fist, still remaining in the pelvis. Many of these cases will eventually need operation.

There are many minor objections to the use of electricity, but time will not permit of my dwelling upon them. Comparing the electrical treatment with the operative, we find that we have in the latter a means which will remove absolutely and forever the offending body, and at the same time enable us to deal with any other disease that may be found. Where the operation is done at the time at which electricity is recommended—that is, prior to rupture—the mortality is *nil*. There is no case on record in which death followed laparotomy done prior to rupture of the gestation-sac. A contrast of the dangers attending and incident to the electrical treatment with those of the surgical is so marked that, for my part, electricity has but one place in the treatment—when the patient has absolutely refused an operation.

DR. PRICE: Mr. President, I want to repeat that if the woman had been operated on after she left the court-room the tubal rupture would, in all probability, have been found, and the abdomen discovered to be full of blood. This I have found in all cases. I could have presented three specimens removed last week which illustrated this point. In two I found the contents of the sac and clots in the abdominal cavity. In none of these cases was the menstrual history worth anything. In one, although the pregnancy had advanced two months, there was only one delayed period. Again, the results of the coroner's work fortify my position strongly—34 deaths—31 of which died of primary rupture ; in 3 the subjects died of a recurring hemorrhage. I could easily cite large numbers of cases dying speedily of primary rupture and hemorrhage.

TWO CASES OF REMOVAL OF LAMINÆ FOR SPINAL FRACTURE.

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Although the following cases terminated fatally, they are here placed on record since it is important at this stage of the surgery of the spine that all cases should be reported, in order that deductions may ultimately be accurately drawn, and that the indications for operation may be finally settled.

The injury in each case was a severe one, as, in fact, is always the case in fracture of the spine. While the cord was not pulpified in the first case, yet the most serious injury was inflicted upon it by the initial traumatism, as was most markedly evidenced by the extreme and rapid formation of bedsores within forty hours after the accident; by the great loss of motion and sensation; and by the rapid development of cystitis.

Had the patient been operated upon earlier, or had she survived the shock of operation, benefit might have resulted, not from the relief of the anterior pressure (which was impossible), but from the removal of the posterior wall, which would have allowed free expansion of the spinal cord and its easier angularity over the prominence formed by the fractured vertebral body.

The relief of the displacement was probably due to the strong extension, which replaced the part in as nearly normal position as was possible.

The clinical symptoms pointed very definitely to the eleventh dorsal vertebra, but the surface nerve indications, which were largely due to pressure of the blood-clot which was subsequently found upon the conus, of course pointed to one or two segments lower. As the segments, however, are very closely huddled in this region, the difference was not very great.

Case I.—A. W., aged fifty-six, a large, heavy, white female; admitted to the Presbyterian Hospital June 2, 1890, suffering from injuries received by falling thirty feet from a scaffolding. The patient was believed to have struck the ground upon her back, not upon her feet or hip. The ambulance surgeon found her stretched upon her back, unable to move either leg, and complaining of much pain in the lower dorsal region.

She was carefully removed to the hospital, where, upon examination, a distinct deformity was discovered in the region of the eleventh dorsal vertebra. Uniformity in the lower spinous processes was broken by decided flexion to the left of the tenth or eleventh dorsal spine. Every movement gave great pain. No crepitus could be elicited. The erector spinæ group of muscles was rigid and resistant, and pressure about the eleventh dorsal elicited sharp cries of pain. The patient was absolutely paraplegic, and a superficial examination showed loss of sensation in both legs below the knees. The shock was still very great, and she answered with difficulty, but there was no delirium or stupor; on the contrary, she was restless and querulous, and complained of headache. There was no anæsthesia or change of sensation above the point of fracture. Respiration was feeble; pulse 85; temperature 99°. There was no history of alcoholism. The sphincters of the bladder and rectum were retentive, and necessitated the use of the catheter. Her health had been poor for several years.

Extension and counter-extension made a slight improvement in the amount of deformity, but did not give absolute replacement. Strong traction, however, modified and improved the condition so much that it was decided to apply it continuously. Fifteen pounds were, therefore, applied to the legs and a corresponding amount of upward traction was exercised upon the trunk continuously. She slept well under a small dose of morphia, and on the following day the deformity was decidedly less conspicuous than on the first examination. The use of the catheter was still demanded, and an enema was not ejected through loss of the contractile power of the intestine. During the day the abdomen became greatly distended and tympanitic, and vomiting was very constant; it became necessary to give her nourishment by enemata. The conditions of motion and sensation were no worse than on the previous day. Across the entire sacrum and the posterior part of the pelvis the skin showed signs of rapid sloughing.

The patient was placed upon an air-bed, and every precaution taken to

prevent bed-sores, the appearance of which was imminent. There was no dribbling of urine; the patient was perfectly dry, with the exception of the presence of perspiration, with which she was frequently bathed.

On the following day the deformity was still further reduced. The tenderness was still located in the same region. The stomach was retentive, and the mental condition much improved. The abdomen was still tympanitic, but food could be taken in small quantities. Enormous bed-sores involving both buttocks were rapidly progressing. Sensation apparently returned to a slight degree, particularly in the left leg, but the patient's mental condition was so poor that her responses were not accurate. The tympany was very marked, and respiration difficult. There were signs of hypostatic congestion at the base of both lungs. Pulse and temperature were unchanged.

The patient was placed upon her face, and, contrary to the general rule, respiration was decidedly improved thereby, and she experienced marked relief from the tympany, since by this measure the gas was driven from the intestines, a result which an enema had previously failed to accomplish. A large enema brought away a few masses of fæces, but there was no response in muscular tone.

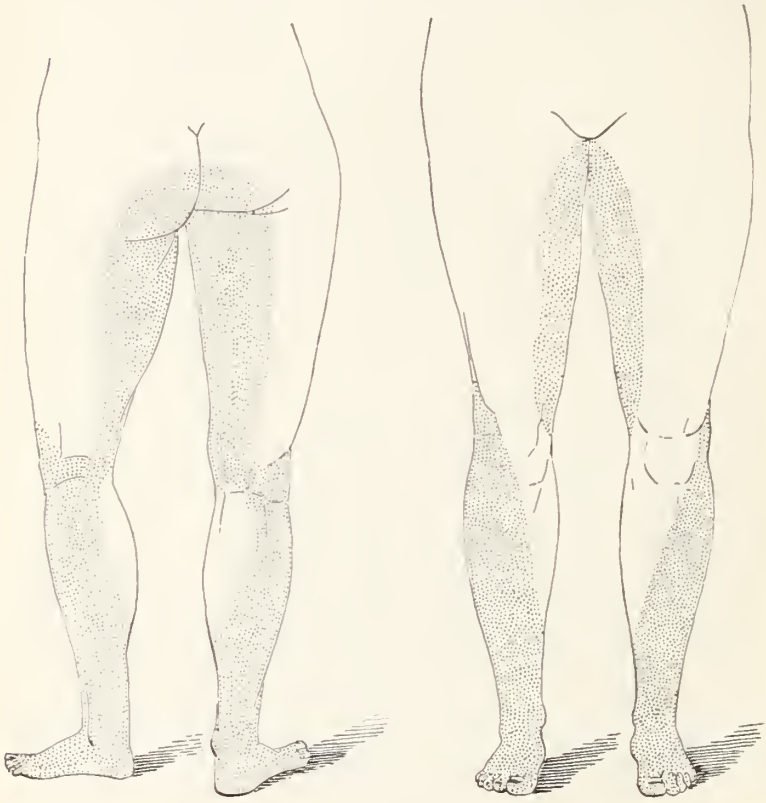
During the next two days slight improvement took place, but on the fifth day following the accident the sphincters of the bladder and rectum relaxed, and incontinence of both urine and fæces occurred.

A careful study of her case was made in connection with Drs. Mills and Lloyd, with a view of determining, if possible, the seat of the lesion by the signs afforded by the peripheral motor and sensory areas.

It was found that motion of both legs was entirely absent; slight rotation at the hips being the only voluntary motion capable of being performed by the patient. Sensation was absent on the back of thighs and in the region of the coccyx, anus, perineum, and external genitals; also, on inner side of thighs. Sensation was entirely absent below the knees, except in the area supplied by the internal saphenous on inner side of legs and feet. Sensation was present on the front and outer side of thighs, and on inner side of leg. In general terms, sensation was preserved in the distributions of the lumbar plexus and lost in those of the sacral plexus. The anæsthetic areas were supplied by nerves arising from the fifth lumbar to the coccygeal segments. The deeply-shaded portions in the accompanying diagram (p. 42) show where the loss of sensation was complete; the lighter portions where it was present. The patient could feel when a pin was thrust into the area supplied by the internal saphenous nerve, but said that it did not give her pain.

Upon accurate mapping of the peripheral exponents, the central nerve-lesion was located at the second lumbar segment where it is protected by the bony frame-work of the twelfth dorsal. The localization symptoms thus placed the seat of the lesion a little below the point shown by the surgical indications and the clinical symptoms. As the tympany, cystitis, etc., were steadily growing worse, and the woman was rapidly sinking, it was

decided to make an attempt to relieve the posterior pressure upon the cord, with the faint hope that sufficient vitality might be restored to the injured parts to permit them at least to live, and possibly arrest the rapid sloughing.



Accordingly, an incision was made over the lower dorsal vertebræ, Drs. Allis, Porter, Reed, Mills, Lloyd, and others being present. No difficulty in respiration was experienced after the patient was turned upon her face following complete anæsthesia. The dorsal muscles were dissected from the spinous processes, and the laminæ cleaned by a strong periosteum knife. The incision was made slightly to the left of the spinous process, in order that the resultant cicatrix might have less subsequent pressure. Very slight motion between the eleventh and twelfth dorsal was elicited upon strong pressure. From the multiplicity of their attachments the cleaning of the laminæ from the muscles was a tedious operation, but when the lamina of the

eleventh dorsal was exposed it was carefully sawn away by a sharp Hey's saw and removed from the cord. Three spiculæ of bone were seen lying upon the lateral posterior aspect of the cord, which were removed by forceps.

The dura at this point was healthy, and the cord pulsated normally. No movement of the fragments could be secured, but there were evidences of marked pressure at this point.

As the result of the peripheral study had located the lesion somewhat lower, the laminæ of the twelfth dorsal and of the first lumbar were now removed by a strong narrow pair of Hopkins' rongeur forceps, the lower flat blade of which permitted it to slide down between the lamina and the cord, after which the sharp upper blade easily removed a semicircle of bone. By thus gnawing downward all danger of injury to the spinal column was avoided, and the pieces were easily removed. No more spiculæ of bone were found, and the cord with its membranes presented no pathological appearances other than those of moderate congestion.

Opposite the first lumbar, however, the bulging and the redness warranted the opening of the dura, which was accordingly done. A gelatinous mass beneath filled the opening. There were a few spots of ecchymoses, but the cord was not compressed by blood.

The slit made in the dura was closed with catgut, and posterior pressure having been entirely removed to allow of expansion, the wound was closed with deep-muscle stitches, with a separate set for the skin, hoping that the spiculæ of bone already mentioned had been partially instrumental in producing the pressure described. Drainage-tubes were introduced, and the wound thoroughly cleansed and dressed with every antiseptic precaution.

The woman—whose condition had been very serious from the time she entered the hospital, and who bore the operation badly—appeared at the point of death several times during the manipulations. She rallied for an hour after, under vigorous external and internal stimulation. Her condition grew slowly worse, however, and she died six and a half hours after the completion of the operation, apparently from failure of respiration. Her condition was too feeble to determine whether there was any return of power or sensation in her lower extremities.

Post-mortem examination.—The body of the eleventh dorsal vertebra was found to be fractured both transversely and longitudinally, with considerable comminution of the bone. The transverse fracture encroached upon the spinal canal, and sharp spiculæ were pressing upon the anterior surface of the cord. There was no evidence of fracture elsewhere in the spinal column. A clot of considerable size, which had evidently formed at the time of the fracture of the vertebra, was found resting against the posterior portion at the twelfth dorsal vertebra, and evidently was causing pressure upon the cord. Eight inches of the cord, including the cauda equina, were removed from the canal. The dura was closely adherent to the bodies of the eleventh and twelfth dorsal and first lumbar vertebræ. The dura was lifted up pos-

teriorly, when the conus was seen through the arachnoid membrane. It presented a highly congested appearance from the eleventh dorsal vertebra down to the cauda. No visible clot pressed upon its surface, but upon a careful study it was discovered by Dr. Mills, after a thorough separation of the filaments of the cauda, that one-half inch of the extremity of the conus medullaris presented a disorganized, reddish appearance. Blood was present in the meshes of the nerves immediately surrounding the conus. The appearances indicated that a hemorrhage had taken place immediately in the conus and had leaked into the adjacent cauda. This could not be discovered when the cord was first removed. Above the disorganized conus, and in the long intra-spinal space below occupied by the nerves, no blood was found. The hemorrhage seemed to be a localized, comparatively small, extravasation from a small artery in the terminal portion of the cord.

The upper limit of the lumbar enlargement presented a bruised appearance. At a point which probably corresponded to the fracture, the cord was somewhat softened; this may, however, have been a post-mortem appearance.

As far as could be determined, the fracture had caused only a moderate amount of permanent compression of the cord, the primal injury having been, however, very severe.

Case II.—A. B., aged thirty years, male, fell from the roof of a car through a trestle about fifty feet, striking upon his shoulders. Presumably he did not strike the trestle, and the point of impingement against the ground is also uncertain, as he bore no external mark of injury. The conclusion, therefore, would seem to be that he struck squarely upon the upper posterior part of the shoulders and back.

When found, he was conscious and sitting up, but totally paralyzed in the lower extremities. The shock, however, was so great that his condition did not permit his removal to the hospital (some twenty miles distant) until the following day. He was attended by Drs. Corson and Woodland, and rallied during the night.

On admission, he presented total loss of motion and sensation of all the parts below the diaphragm. No response could be elicited by a pinch below a line corresponding to the lower margin of the ribs and a circle surrounding the body at this level. Over a zone varying from an inch to an inch and a half in width, just below this area, he was conscious of feeling the impingement of a pin, or of any body, but was not conscious of a pricking sensation until the upper level or margin of the ribs was reached.

The sphincters of both bladder and rectum were retentive, and required the use of the catheter. The abdomen was only slightly distended. Respiration was free and easy. The heart was acting naturally. He was quite conscious, and suffered only when the region of the injury was pressed upon. There had been no vomiting, and he took both liquid and solid food with comfort.

At a point corresponding with the seventh dorsal vertebra there was a marked prominence, plainly visible to the eye as well as to the hand. Over the fifth and sixth spines was a decided deviation. No crepitus could be elicited, but pressure gave great pain.

Diagnosis: Fracture, with displacement. The condition of the cord was, of course, uncertain, but it was probably severed. Strong extension to the head, armpits, and feet failed to reduce the deformity save to a slight degree. Extension was continued through the night upon the legs, pelvis, and arms, and on the following morning slight improvement had taken place in the deformity.

The abdomen had become tympanitic and greatly distended; control of the sphincters had been lost, and bed-sores had begun to form, although the patient had been placed upon a water-bed. The heart's action was feeble and irregular, and the man bore every evidence of rapid dissolution.

After careful examination by Drs. Mills, Allis, Porter, Lloyd, and others, an operation was decided to be advisable in view of the rapid approach of death. The patient was etherized and turned upon his face, which position did not interfere with respiration. An incision was made a little to the left of the spine, in order to keep the line of cicatrization away from pressure. The laminæ were reached as quickly as possible, and the laminal arches on either side of the seventh dorsal vertebra were found to be fractured at their attachments to the spinous process. This portion was carefully removed by the use of the saw and the gnawing forceps, and the membranes of the cord were exposed, showing angularity at this point. The lamina of the sixth dorsal vertebra was then removed by gnawing forceps, when the cord was found to be pulsating and apparently uninjured. Hopkins's narrow flat-bladed rongeur forceps was then inserted along the spine and the sharp projections of the seventh vertebra, which pressed laterally upon the cord, were gnawed away. The laminæ of the eighth dorsal vertebra being removed in the same manner, the cord opposite the injury at the seventh presented a transverse red line or fissure, which bore evidence that its fibres had been ruptured, although, of course, no traction was made upon it to discover whether the separation was complete. Below this point the cord was then exposed for an inch and a half, and it showed evidences of congestion and laceration. All pressure having been removed, such pieces of the fractured body as could be reached were cut away, and the movable portions which extended far beneath the cord, which could not be removed without serious risk and further laceration, were pushed forward and allowed to remain *in situ*, the sharp projections having been cut away. There was no evidence of severe hemorrhage within the canal. The wound was then drained, rendered aseptic, and the deeper muscles united by catgut sutures. The skin and superficial muscles were then brought together. An antiseptic dressing was applied, and the whole posterior part of the thorax covered with cotton.

October 28, 1890. The patient slept through the night without an anodyne, and had but little local pain. Oozing of blood from the wound was considerable. At the time of the operation the hemorrhage had been quite free, not from the arterioles, which could be ligated, but from the venous vessels and from the divided muscles. The temperature was 99°, pulse 100, respiration 28. The heart's action was exceedingly feeble, but respiration was greatly improved. The tympany had largely subsided. The catheter was used regularly, so that apparently there was no incontinence. Flatus was passed from the intestines, but no feces. A pin's point could be distinguished thirteen inches lower on the body, but there was no return of motion. The line of sensation was not accurately fixed, owing to the feebleness of the patient and the uncertainty of his replies, yet upon the abdomen, in the groins, and upon the anterior aspect of the thighs for two inches below Poupart's ligament, and on the outer side of the trochanter, slight sensation was evident. He bore food easily, and was perfectly conscious, although very feeble. Respiration was easy, but shallow; heart's action good. He complained of no pain except from the extension apparatus on his head.

On the afternoon of the second day the heart's action rapidly failed, he sank into unconsciousness, and died forty hours after operation. Autopsy could not be obtained, and the specimen was most unfortunately lost.

Some operators speak of the ease and rapidity with which the spine can be opened, but I have not found the operation an easy one. The numerous muscles of the erector spinæ running in every direction, with their attachments to the spinous, transverse, and articular processes, make the clearing off of the laminæ an operation of considerable difficulty. These masses of muscle, the great depth of the wound, and the difficulties in obtaining access to the neural canal, render the operation in the lower dorsal and lumbar regions a most troublesome one. A cross incision through the skin and muscles will often be of service and give better exposure.

Hemorrhage: The bleeding from the venous and capillary vessels is not material, but from the region of the divided muscular fibres hemorrhage is usually very free, and comes from many points not easy to control. It is better to check all of the bleeding-points with hæmostatic forceps, and not to delay the operation by tying the vessels, unless the forceps are in the way of the operator. Pressure will usually relieve the oozing. I have found hemorrhage within the canal to be of

serious importance. If the venous plexus is injured it will be both annoying and serious. The vessels must be tied or packed.

Time is an important element in the question of shock.

Position of the patient: Contrary to the general expression, I have not found the prone position to interfere seriously with respiration, and it certainly gives a much better field for operation.

In our present state of knowledge it cannot be argued that we have arrived at any definite conclusions as to the state of the spinal cord after injury; loss of sensation and loss of motion indicate very serious trouble, but may be due to continuous temporary concussion. Also, they may be due occasionally to blood-clots or to material pressing upon the cord. When great deformity is present, however, we can be certain that the parietes of the canal are encroached upon, and that there is pressure, even if no spicula of bone be present. It is for the relief of this pressure that inducements can be offered by operation, since it is impossible for us to determine exactly the condition of the cord. It may have been absolutely crushed at the time of the injury. It is frequently torn across, and the prospects of the operation are, of course, faint; yet, without operation, many of these cases remain hopeless and helpless paraplegics. If this pressure can be relieved by the removal of the posterior part of the bony canal, it is worth the trial. I am not enthusiastic in regard to the results to be obtained, yet, when a case is rapidly sinking, and an operation holds out any hope of relief, we are, in certain cases, justified in making the attempt to improve the condition of the patient. In the second case above reported, life was probably lengthened a few hours; in the first, it was but a few days shortened.

The removal of the first lamina is the most troublesome portion of the operation; I am satisfied that the gnawing forceps are the best instruments for this purpose. When once the canal is entered, then the very narrow-bladed rongeurs which I have had constructed for this special purpose, answer most admirably for extending the removal of the other laminæ. The lower blade is flat, and can safely be carried along the

dura. The upper blade cuts cleanly upon it. The lower blade is duck-billed shape, so that it cuts wider than the heel of the blade, thus preventing its becoming fixed in the furrow.

In relation to the term laminaectomy, the combination of Latin and Greek certainly is not desirable, but as the termination ectomy is now so generally employed for the cutting out of a section, it is wise to retain it. The lamina of a vertebra is familiar to all physicians' ears, but to speak of ἔλασμα, and elasmectomy would justly rouse the ire of any ordinary physician. Trephining of the spine is not the correct term, while laminaectomy is accurately descriptive.

DISCUSSION.

Dr. Charles K. Mills: Several points of interest arise in connection with Dr. Willard's cases, both of which I had the privilege of seeing. These relate to accurate diagnosis, the advisability of surgical treatment, and to certain lesions found on post-mortem examination.

While both of these cases terminated fatally, and while the results of spinal trephining have not been highly encouraging, we should not conclude that such operations are not justifiable, nor even sometimes demanded. The cases trephined have, as a rule, been of the most serious character, and would, as a rule, have ended fatally without surgical interference. In some, surgical interference had been postponed too long; and in others the performance of the operation was too much prolonged, particularly in view of the reduced endurance of the patient.

An important point, one not often taken into full consideration, and one sometimes the cause of faulty diagnosis or operative failure, is the frequent presence of multiple lesions from severe spinal traumatism. We may have not only fracture or fracture-dislocation, but bruising or crushing of the spinal cord, and especially hemorrhages of various kinds. In the first place, such hemorrhages may take place into the substance of the cord. They are sometimes minute, punctiform extravasations; sometimes they are of moderate size, and again they may be so large as to cause extensive disintegration of the cord. They are particularly likely to occur in the central gray matter, owing to its softer structure and higher vascularity. To them important localizing symptoms may be due, as much as to destruction, irritation, or pressure from fracture or fracture-dislocation. Extra-meningeal and intra-meningeal hemorrhages, of course, also occur, and may be of large size. Thorburn, for instance, reports a case in which was found extravasated

and coagulated blood, external to the dura mater, throughout the whole distance from the sixth cervical vertebra to the inferior termination of the canal, dislocation, fracture, and intra-spinal hemorrhage being also present. In a case like this it is almost impossible to make a diagnosis of all the conditions present, and the surgeon may, therefore, be justified in exploratory trephining.

In cases with little or no deformity, the effects of these hemorrhages may greatly cloud the diagnosis, especially of the level of the lesion. In the first case reported by Dr. Willard, the external appearances and local suffering pointed to the eleventh, or possibly the tenth, dorsal vertebra as the seat of the greatest injury. The motor paralysis was nearly complete for both lower extremities, and supposing it to have been due to direct interference with the cord, also indicated a lesion as high as the upper limit of the lumbar enlargement, although often much of the palsy in such a case may be due to pressure, or even to inhibition of parts adjoining the active lesion. The anæsthesia, however, which was the most distinctive localizing symptom, pointed to a lesion lower than the place of slight deformity and great pain. Below the knees anæsthesia was nearly complete. Above the knees sensation was only absent on the back of the thighs, and in the region of the coccyx, anus, perineum, and external genitals; it was present, roughly describing, on the front and outer side of the thighs, and on the inner side of the thighs, leg, and foot—in other words, in the areas of the ilio-hypogastric, ilio-inguinal, genito-crural, external cutaneous, middle cutaneous, internal cutaneous, long saphenous, and obturator nerves—the branches of the lumbar plexus. Sensation was absent in the distribution of all the nerves of the sacral plexus. The areas devoid of sensation were supplied by nerves arising from the fifth lumbar to the fifth sacral and coccygeal segments of the cord, which are situated chiefly opposite the body of the first lumbar vertebra, considerably below the external pointings. The lesions causing this anæsthesia might indeed have been still lower, where the nerves affected pass out of the spinal canal, the highest of the nerves involved making its exit as low as the fourth or fifth lumbar vetebra. The anæsthesia may, in other words, have been due either to a hemorrhage, or other lesion, pressing upon or invading the conus medullaris, or to a hemorrhage welling up and enveloping the nerves of the cauda equina as high as the fourth lumbar vertebra.

In making a diagnosis in such cases, therefore, the strictest attention must be paid to the functions of the spinal segment, to the intra-spinal course of the nerves, and to their points of exit. This is particularly true with regard to lumbo-sacral intra-spinal lesions, owing to the small vertical extent of this portion of the spinal cord, and the long intra-spinal course of the nerves. In Dr. Willard's case, not the fracture directly, but hemorrhage into the conus and mesh of nerves around it, was doubtless the cause of the localized anæsthesia.

This small hemorrhage in the tip of the conus and surrounding cauda

equina is of particular interest. Usually, when we speak of hemorrhage into the lower portion of the spinal cord, we have in mind extensive extravasations filling the loose, large spaces of the canal. Evidently, however, as this specimen indicates, hemorrhage sometimes takes place into the conus itself. Into the small conus, in accordance with its anatomy and functions, is crowded a relatively large amount of gray matter presiding over important locomotor and visceral apparatus; and the blood-supply here is, therefore, of the fullest character. It may be that under concussion or direct injury, a special tendency to hemorrhage into this region exists, just as in the brain we have a region into which hemorrhage is most likely to occur.

Thorburn, who gives a number of instances of hæmatomyelia, both without and with other lesions, speaks of two methods of production of these intra-medullary hemorrhages: in one the cord has been concussed or jerked violently backward and forward against its containing canal, and thus bruised; in the other occurs a diastosis, or partial dislocation with recoil. He does not favor the idea of concussion, but rather that of flexion. The cases to which he is alluding in his remarks all occurred at the summit of the arch formed by the cervical curve, and, therefore, in the region where an acute bend of the neck would make itself mainly felt. Probably the lumbo-sacral hemorrhages often occur in a similar way with reference to the lumbar curve.

In not a few cases of spinal traumatism, with or without evidences of fracture, and in which the symptoms indicate a lesion involving the cauda equina or the conus medullaris, the patients greatly improve. It is probable that in some, at least, of these cases the lesion is a small hemorrhage into the conus and environing cauda, similar to the extravasation present in Dr. Willard's case. Absorption and repair cause some, and it may be most, of the symptoms to disappear, other more serious and permanent bone or articulatory lesions not being present. In a paper in the *Medical News* of March 1, 1890, I have recorded two cases of this kind. In the first of these the diagnosis was made of hemorrhage into the cauda equina, with involvement of certain sacral nerves. The patient had marked anæsthesia in the distribution of the small sciatic, pudic, inferior hemorrhoidal, and inferior pudendal nerves, with imperfect anæsthesia of other areas; with also paralysis of the muscles supplied from the sacral segment, and with vesical and anal involvement. This man greatly improved under time and treatment, and has for a long period been able to work. In another case, apparently of fracture with hemorrhage into the cauda equina, similar sensory, motor, and visceral symptoms were present, but were less marked, and the patient made decided improvement.

In another unreported case sent to me for opinion, the patient nine years before had fallen about four feet, alighting upon his buttocks. He at once had a feeling in the upper part of his legs of numbness and tingling. His right leg soon became anæsthetic, the anæsthesia extending to the middle of the thigh and the gluteal region, and he completely lost control of the bowels

and bladder for three months after the accident. He also had some weakness in both legs below the knees, but could not give any details as to the movements most affected. He thought that after three or four months he had completely recovered from the motor and sensory paralysis, but he never had gained full control of his bladder and bowels, and sexual power was abolished. Two months before coming for advice, his left leg again began to lose power. On examination I found some paresis of this limb, most marked for certain movements of the foot, particularly extension and abduction. On the left side, knee-jerk, muscle-jerk, ankle clonus, front tap, and toe-jerk were all marked; on the right, knee-jerk and muscle-jerk were present but less marked than on the left, and front tap, ankle clonus, and toe-jerk were absent. He had at times jerkings or twitchings of the leg.

To me the most interesting condition, however, at least the most interesting in connection with the original injury and the symptoms following it, was the existence of absolute anæsthesia of the anus and a narrow ring or rim around it, sensation being elsewhere perfect. It is probable that at the time of the injury a hemorrhage took place into the conus and surrounding cauda, causing at first comparatively widespread anæsthesia with loss of power in the muscles supplied by the nerves from the lowest segments of the cord, and also anal, vesical, and sexual paralysis. This lesion largely disappeared under time and treatment, but the evidence pointed to destruction of the vesical and anal centres, and the sensory centres for the skin about the anus and coccyx, or of the nerves originating from these centres.

As the man had a specific history, the paralysis of the leg which had recently redeveloped might have been due to some intra-spinal specific lesion which had been started at the site of the old trouble.

The autopsy on Dr. Willard's case, and the histories of these and other cases which have fallen under observation, at any rate, lead me to believe that hemorrhage into the conus and the nerves surrounding it is a not uncommon lesion in spinal traumatism, and one from which the patients make partial, although seldom complete, recoveries—one also which must be taken into account in cases of fracture and dislocation. In some of the disputed cases of so-called "spinal concussion," the possibility of this occurrence should also be borne in mind.

Certain general rules for the selection of the spines and arches to be first removed in cases of spinal trephining might be of service, and readily supplied to the surgeon. The surgeon will usually find it necessary or advisable to remove at least two or three spines and posterior arches, either for diagnosis or for therapeutic purposes, and one of these ought to be easily chosen. This can be most readily done by dividing the spinal column into six parts, namely: (1) an upper cervical, (2) a lower cervical, (3) an upper dorsal, (4) a lower dorsal, (5) a lumbo-sacral, and (6) a cauda-equinal. In the upper cervical region the point of selection for operation might be the third cervical vertebra, in the lower the sixth cervical vertebra; in the upper

dorsal it would be the third or fourth dorsal vertebra, and in the lower dorsal the seventh or eighth dorsal vertebra; in the lumbo-sacral region the twelfth dorsal vertebra; and in the cauda-equinal region the third lumbar vertebra.

Certain dominant types of paralysis, sensory and motor, sometimes accompanied by striking reflex visceral or other disturbances, will generally refer the investigator at once to one of these regions; for instance, the upper-arm type of paralysis with involvement of the deltoid, biceps, coraco-brachialis, supinator, rhomboid, spinati, neck muscles, and diaphragm, to the upper cervical; or the lower-arm type of paralysis, showing chiefly involvement of muscles below the elbow, to the lower cervical. In the dorsal region the guide will be chiefly the height of the sensory disturbance.

While the segmental localization of the lumbo-sacral spinal cord has been carefully worked out for injuries of this region and of the cauda equina, the facts necessary to be known by the surgeon can be much simplified. It is practically only necessary to separate lesions of the lumbo-sacral spinal cord proper from those of the cauda equina below the tip of the conus. This lumbo sacral region lies almost entirely opposite two vertebræ, the twelfth dorsal and the first lumbar. The upper free portion of the cauda equina lies chiefly opposite the second, third, and fourth lumbar vertebræ. In any case of suspected lesion of the lumbo-sacral spinal cord, therefore, as suggested, a good plan would be to operate for the twelfth dorsal vertebra, and the operation could then be readily extended upward or downward. If the lesion is supposed to affect the cauda equina entirely below the conus, the third lumbar vertebra might be first selected.

In some forms of injury to the spinal column and cord, a diagnosis of the height of the lesion can be made with considerable accuracy by a single observation of the patient. This is particularly true of certain injuries to the cervical region. In the work of Thorburn on the *Surgery of the Spinal Cord* will be found two pictures, one showing the position occupied by the limbs in a case of complete transverse destruction of the spinal cord, immediately below the level of the origin of the fifth cervical nerves, the other showing the position of the limbs where the fifth cervical nerve-root was injured on the left side only. One day some months since, in passing through my wards at the Philadelphia Hospital, I noticed a man with elbows flexed, and forearms drawn upward, his hands and fingers limp and flaccid. His appearance at once recalled Thorburn's case, which I remarked to my interne, and stopped to make a careful study of the case.

The patient was a colored man, twenty-nine years of age, who had fallen down stairs three days before while intoxicated, and after the fall could not walk. He was brought by the ambulance to the hospital. He had some muttering delirium, and seemed confused, understanding only imperfectly what was said to him. Temperature 99°, respiration 24; pulse 78, weak and compressible. He was on his back. The arms were kept flexed and lying across the chest. He held his upper extremities in a peculiar, wing-like

position—drawn up and the forearms flexed on the arms and carried over the chest, the fingers and hands being at the same time helpless in a half-flexed position. Testing him as far as his condition allowed, he could elevate and abduct his arms fairly well, better on the right than on the left side.

The position of his fingers, hands, and forearms indicated that he had paralysis of the flexors and extensors of the wrist and fingers, of the interossei, and generally of the muscles below the elbow. He had slight supinating power. Sensation could not be determined accurately on account of the condition of the patient. It was apparently blunted to the elbow, more on the ulnar side of the hand and forearm on both sides, corresponding to the median and internal cutaneous, and possibly posterior cutaneous and palmar ulnaris. On the body sensation was impaired to a level with the second rib. The legs were absolutely paralyzed, both for motion and sensation. He had some difficulty in getting his breath, and once had a rattle in his throat, which disappeared in a short time. He had a cough, slow, short, soft, and distant-sounding in character. He had incontinence of feces and urine, and priapism. While examining him he suddenly became much worse; breathing became gasping. He rallied again for a few minutes, and was given a hypodermic of atropine and digitalis; but in a few minutes he sank again and died.

Of interest in connection with this discussion are some specimens which I will show from an old case of serious spinal traumatism. The patient from whom this specimen was removed had, several years before death, fallen from a height. The case was reported in my paper already referred to, "On Lesions of the Cauda Equina." It was reported as a case of probable fracture of the spine, with hemorrhage into the lumbo-sacral spinal cord and cauda equina; with marked anæsthesia in the distribution of the sensory nerves from the fourth lumbar to the coccygeal segments, and almost complete paraplegia of the muscles supplied from the third lumbar segment to the extremity of the conus; with also advanced vasomotor, trophic, and electric changes.

The patient died September 5, 1890. A careful spinal autopsy was made. An extreme angulation of the spinal column was found at the position of the twelfth dorsal and first lumbar vertebræ. The two vertebræ were jammed together so as to look like one large mass, and the entire spinal column was twisted. The displacement was opposite the lumbar enlargement and conus. The cord at this point was contracted and flattened. No gross signs of old hemorrhage were discovered. Some of the nerves of the cauda were evidently atrophied. The entire spinal cord, with the cauda equina, the sciatic nerves, and the brain, were removed and hardened for microscopical examination.

Dr. George E. Shoemaker: I shall briefly refer to a case bearing upon the diagnosis of these troubles, which was admitted last August to the Presbyterian Hospital in the service of Dr. W. G. Porter, and in his absence

coming under my charge. The patient was a brakeman, of great physical strength, and with a remarkably thick neck. He had fallen backward from a box-ear, striking on the back of his neck. He was perfectly conscious when admitted, and had very little shock. There were motor paralysis, anæsthesia below the deltoid muscles, marked priapism with abolition of reflexes, and retention of urine and fæces. No deformity of the neck could be detected, probably owing to its great thickness. No spinous process could be made out. The head was held stiffly, and was thrown rather backward. The only pain was between the shoulders on motion. The diagnosis was probable fracture, but this could not be separated from hemorrhage. The lesion was evidently about the sixth or seventh cervical vertebra. During the evening his temperature rose from 103° to 105°, and by the time of his death, eighteen hours after the accident, it had reached 108°. The pulse and respiration rate increased steadily in frequency, but did not lose their proper rate relation. The respirations were 30 two hours before death, but showed no irregularity until near the end.

At the autopsy, which was unfortunately interrupted while incomplete, there was found this Y-shaped piece of bone, which consists of the spinous process with two thin prongs, an inch in length, broken from the lower portions of the laminæ of the sixth cervical vertebra. It was forced inward, and tilted downward so that the tip of the spinous process rested on the base of the spinous process below. This brought the fork of the Y-shaped fragment against the cord. There was extensive hemorrhage up and down, to which the paralysis was probably in part due. The cord evidently was not pulpified, but there was no opportunity to examine it carefully.

It is difficult to understand the exact mode of death in these cases, so often fatal. Here was absolutely no sign of brain injury. The medulla was not involved, as shown by the respiration. The phrenic was not paralyzed by extension of hemorrhage, for the deltoids were never paralyzed, and there were no extra inspiratory efforts by neck muscles. The man did not die of shock, or of exhaustion in the ordinary sense. There is an obscure, but profound, nervous impression, as shown by the temperature.

Dr. Richard H. Harte: I have noticed that in these cases the temperature often rises greatly, even when there is no inflammatory complication. Always before dissolution the temperature rises, as in the case mentioned by Dr. Shoemaker. As has been said, the operation is a difficult one. Dr. Willard states his preference for an incision to one side of the median line. While this would facilitate the operation on one side, it would render it more difficult on the other. I think that opening of the canal can be simplified by dividing the infra- and supra-spinatus ligaments, and removing the spinous process with bone forceps. One can then apply a trephine and remove a disc of bone. Then, with rongeur forceps, the wound can readily be enlarged. I have found Hey's saw objectionable, because, with this instrument, if we wish to divide only one lamina, we must, to a certain extent, injure the lamina above and below.

In regard to the diagnosis—which is, of course, difficult—there are several places where we look for these injuries. Most of these cases are the result of forced flexion. It is well known that under these circumstances the spinal column is apt to give way where a movable and immovable portion join—for instance, where the lumbar vertebræ join the comparatively immobile vertebræ of the thorax. In the cervical region the vertebra may give way where the column joins the skull, or about the sixth or seventh cervical, or where it joins the dorsal.

In a recent case admitted to St. Mary's Hospital, where a man had been wrapped around a shaft, complete luxation had taken place, the head and neck being driven down between the shoulders. The paralysis was much as has been described by Dr. Mills. Extension and counter-extension were made, and the luxation apparently reduced with a sharp thud. Pain was relieved, and the man rested well during the night. In the morning he began to have peculiar variations of temperature, and in about six hours the temperature went to 108°, and he died. In this case there was complete separation of the bodies of the last cervical and the first dorsal vertebra. There was also fracture of the articular processes, with complete division of the cord. From the fact that reduction was made, one would naturally consider this case as one of simple luxation, with pressure on the cord from the bodies slipping by each other. This might have led one to think that laminectomy was indicated, but the autopsy showed that operative interference would have been useless.

Another case was seen at the Episcopal Hospital some months after the injury, which had resulted from forced flexion. The man had gone through the usual stages of such an injury. He still had a certain amount of hyperæsthesia, especially in the right leg. In this case I opened the spinal canal, and it was found that there had been a partial luxation, the membranes thickened, and cord compressed. This case improved to a certain extent after the operation. The temperature, however, went up, and there occurred cystitis. The man is now apparently little better than before the operation; if the operation had been performed earlier, the result might have been different.

Dr. W. W. Keen: I wish to refer briefly to only two points. In the first place, I would ask Dr. Willard if, in reviewing the conditions presented in the first case, it would not seem to him best in a case attended with such evidences of severe lesion to withhold operation? It seems to me that the injury was so severe, and the complications arising so extensive and dangerous, that I should hesitate a little in regard to the wisdom of an operation.

The second point is in regard to the technique. Some three or four months ago I had made a pair of rongeur forceps for the purpose of doing a craniectomy. I did my last operation two weeks ago last Monday, completing it in half an hour instead of an hour and a quarter, as in the first

operation. It will be noticed that this forceps is similar to that of Dr. Willard. The end is broader than the heel, the object being that the instrument shall not bind. Even then I have found it necessary to cut laterally a little. The upper blade is perforated, the opening being of a conical shape. This enables the instrument to clear itself of bone. The lower lip projects a little beyond the upper. Last Saturday I did also a laminectomy, and found these forceps to answer well. The trouble is in making the first opening into the canal. I do not like to use the saw. I removed the first lamina with these old double-gouge forceps which I have had since 1866. With this I cut away the first spine and lamina without the slightest difficulty. After the spinal canal had been opened, the rongeur forceps I devised answered admirably, even better than Mr. Horsley's instruments, which I tested at the same time.

Dr. William Barton Hopkins: The spinal rongeur forceps here shown was designed by me about three months ago, and was exhibited at the last meeting of the Academy of Surgery. The instrument consists of an upper cutting blade and a lower jaw which acts as a counter, as in the cranial

Hopkins's Spinal Rongeur Forceps.

rongeur forceps devised by me some years ago. The upper blade has upon its lower margin a double cutting edge an eighth of an inch wide, and is fenestrated with an opening larger at the top than below, to allow of the free egress of chips. The lower blade enters between the edges of the upper one-sixteenth of an inch, and will, therefore, cleanly incise dense fibrous tissue as well as bone. The lower jaw has a gradual bevel from before backward in order that it may follow in its track without binding; a shoulder at its heel acts as a gauge to indicate the depth it occupies in the bone. The whole instrument has an S-shaped curve that it may be more readily manipulated in the bottom of deep wounds, but care has been taken to preserve the parallel between the axis of the blades and that of the handles. The handles are made with stops to give good purchase in thrusting the instrument forward. The requirements which it has been sought to fulfil with this instrument are: first, to enter the continuity of the spine and divide the laminæ with a single instrument; second, to make a clean, narrow bone-wound which can be approximated if desired; third, to lay bare an extensive

portion of the cord with rapidity, and without risk of injury to it or its membranes. Experimenting upon the cadaver it is found to enter the spine at any point (cutting always from below upward) with great ease, and with it sixteen laminæ at the dorsal spine were cut away, exposing the cord in eight vertebræ, in seven minutes. Though intended particularly for the spine, its probable adaptability for craniectomy has not been lost sight of.

Dr. Keen: I was not aware until after I had devised my forceps that Dr. Hopkins was on the same track as Dr. Willard and myself. The objection which I have to his forceps, although it has certain advantages, is that it is too narrow, especially for removal of the laminæ. It makes practically an incision in the bone rather than removes any considerable portion of tissue. By his kindness I tested this also at the same laminectomy.

Dr. John Ashhurst, Jr.: I understood Dr. Willard and Dr. Mills to speak of incontinence of feces. Do they really mean incontinence, or that the bowels were evacuated without the patient's knowledge? This difference is one of some importance. In ordinary cases of spinal fracture there is retention of urine, and after a time the bladder becomes full and overflows, but there is no true incontinence until a later period. In the rectum, also, there is retention of feces for perhaps a week or ten days, and then the rectum, having become filled with fecal matter, is evacuated without the patient's knowledge, simply because the power of feeling is destroyed. After the bowel is emptied, retention again occurs until the circumstances are reproduced, or until degenerative changes have involved the cord below the point of injury. If there were true primary incontinence of feces, it would indicate a lesion low down, for, as we know, the sphincters are under the control of the lowest portion of the cord. If there were primary incontinence of feces with a high lesion, it would show such extensive injury to the cord as would preclude any hope of benefit from operation.

Dr. Willard: I used the saw in the first case because I had no gnawing forceps at hand. With the ordinary bone forceps there is danger of crushing the inner plate of the lamina and wounding the cord. The gnawing forceps seems to be decidedly better than the trephine or the saw. I, however, know of few operations more difficult and annoying than working in a deep cavity and trying to divide the laminæ.

In the first case, I would say, in reply to Dr. Keen, that although the woman was suffering with extensive bed-sores, yet the pain, cystitis, etc., were so severe, and she was so rapidly sinking, we thought it well to attempt the removal of pressure, with the hope that sufficient nerve-force would pass to keep the parts alive, even if she did not regain the power of walking.

I wrongly used the term incontinence. On the morning preceding the operation, the contents of the bowel and bladder were passed in bed. This was probably an evacuation of feces, and not true incontinence.

GLUCK'S IVORY JOINTS FOR REPLACING EXCISED ARTICULATIONS.

By De FOREST WILLARD, M.D.,
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[Read February 4, 1891.]

Among the most novel, but certainly not the most useful, of the matters brought before the recent Congress at Berlin were the ivory joints of Gluck, as a substitute for articulations which have been excised. I show them, not because I believe that they are practical, but to illustrate (as Dr. Gluck has demonstrated in the eight persons whom I examined) that they can be introduced without producing undue inflammation, and that the employment of ivory for this purpose may become feasible in the continuity of the bone and in ununited fractures.

The artificial joints, of which he has a variety for the various articulations of the body, consist of two or more pieces of ivory fashioned into a joint and fastened together with an axle or pin. The two shafts which screw into the epiphyseal portions are intended to be driven into the medullary cavities of the bones above and below the joint.

The medullary cavity after an excision is first to be curetted and scraped, after which the ivory shaft is driven with great force into the shaft of the bone. These extremities are then attached, by the screw contrivance already mentioned, to the articular portion.

I show you here the articulations intended as a substitute for the knee-, hip, and elbow-joints. The knee-joint has

simply a ginglymoid motion, and can be flexed to the right angle. The piece intended to be driven into the femur is five inches long; that for the tibia four inches from the centre of the articulation. Perforations are made in the shaft, intended to admit the entrance of granulation-tissue into its interior, and it is made also hollow for a similar purpose.

The hip-joint, by a double mechanism, gives the ball-and-socket rotation with abduction and adduction. A plate is provided, which is screwed to the acetabulum.

At the elbow a forked section is intended to be driven into the radius and ulna, while a single section is provided for the humerus.

In an article in the *Berliner klinische Wochenschrift*, 1890, No. 32, denominated "The Invagination Method in Osteoplastic and Arthroplastic Surgery," and also in the *Transactions of the Tenth International Congress*, Gluck presumes upon the fact that the medullary cavity of the bone seems to possess an almost unlimited tolerance for the driving in of any kind of organic or inorganic foreign bodies. If these bodies are smooth and aseptic, they do not cause inflammatory reaction, either mechanically or chemically.

His experiments with both solid and hollow bodies, as well as with nickel-plated, silver, and steel substances, have demonstrated that ivory is best fitted for this use. He drives them with great force into position; so great is the force that, in two instances which I saw, he produced fracture and splintering of the bone, but this, he remarked, "was of no consequence."

If necessary to fix them more thoroughly in position, ivory pegs can be inserted. He considers that the implanted material serves as a stimulant and a conductor for repair, while absolute fixation gives comfort from the beginning, and prevents myospasm and secondary hemorrhage from trauma.

The absence of all pain after the operation the author attributes to the destruction of the sensory filaments by the preliminary curetting of the medullary cavity.

He claims that the insertion of these foreign bodies (and this claim seems to be supported by the temperature-charts of

his cases) has not awakened inflammatory symptoms. In one case, however, he was obliged to remove the joint, as the part did not heal and the ivory became loosened. In all the joint-cases which I examined, the wound had not entirely healed, and the pus was still oozing from the sinuses. In no case had the patient attempted to walk upon the member. In one case of resection of the knee the ivory articulation was protruding through the skin, but Dr. Gluck seemed to feel hopeful that he should, in time, be able to cover it with granulation-tissue. Whether this has since occurred I do not know, but I must confess that I have my doubts as to the practicability of even securing a temporarily good result.

The medullary cylinders are made of different sizes to be screwed to the diaphyseal articulating portion, but all have exactly the same sized screw-worm, so as to fit any articulation.

He insists upon absolute fixation of these portions of the apparatus in the bone, so that there can be no mobility.

In an articulation like the knee, after the part had healed, should the central peg or axle become loosened or worn, or should fracture occur, it might precipitate the patient somewhat suddenly, at the risk certainly of his new joint, if not of the other portions of his body.

Still, as I have said, the experiments are useful in showing the tolerance of bone to foreign bodies, and I believe that in the continuity of the shaft the plan of introducing ivory sections may yet prove to be useful. In cases of loss of substance in ununited fractures, these new sections may possibly also be employed.

The experiments of Hopkins and Penrose[1] with sterilized bone dowels, show that under favorable circumstances, in contact with living bone, organization may occur, or a process of partial absorption combined with a process of repair may take place. Even the temporary bridging of a chasm may be useful by initiating the work of repair.

[1] Journ. Amer. Med. Association, April 5, 1890.

LIGATION OF THE COMMON CAROTID ARTERY IN A CHILD OF THREE AND ONE-HALF YEARS, FOR HEMORRHAGE FOLLOWING PERITONSILLAR ABSCESS; RECOVERY.

By THOMAS D. DUNN, M.D.,
OF WEST CHESTER, PA.

[Read March 4, 1891.]

The subject of my report to night is a white boy, three and one-half years of age, with dark hair, blue eyes, and fair, transparent skin. He is the youngest of a family of three children, two boys and one girl. They have had no illness aside from the little digestive troubles and colds to which children are liable. The parents are strong and healthy, though there is a decided disposition to tuberculosis in the mother's family. There has been no special tendency to quinsy, rheumatism, or scrofula, and no hæmophilia in the family. At the time his cold was contracted the little patient was in good physical condition, his weight and strength being above those of the average child of his age.

When first seen by the family physician, Dr. Jacob Price, he had a high fever, rapid pulse, pain in right ear and redness of the fauces. Two days later, December 27, 1890, owing to the illness of Dr. Price, he came under my care. The temperature was then 103° F., pulse 120, with no marked quickening of respiration. The tissues of the right side of the neck were extensively swollen, and he had difficulty in turning the head and opening the mouth. Swallowing was painful, on account of which the little sufferer refused nourishment. The breath was fetid, and the mouth contained considerable mucus.

Examination revealed the right tonsil greatly congested and swollen, nearly blocking the isthmus of the throat. Not only was the tonsil inflamed, but the adjacent parts of the pharynx and palate were involved. A mixture of tincture of the chloride of iron and sweet spirits of nitre was prescribed.

With the exception of increased tumefaction of the tissues of the neck, there was little change in his condition the following day. The swelling now

extended from the mastoid to the symphysis of the jaw. Temperature 102° F., pulse 120. One-grain quinine suppositories were ordered, to which one-twelfth grain of the extract of opium was added to secure rest.

December 29. No change was noted.

In the evening of December 30th the abscess opened spontaneously, discharging a large amount of pus and considerable blood. On account of the latter I was summoned, but did not consider the hemorrhage alarming, regarding it rather as beneficial in relieving the congestion and swelling of the neck. It ceased before I left, without any application to the part. At midnight there was a slight discharge of blood.

At my morning visit he seemed decidedly better; temperature normal, deglutition less painful, and swelling of neck diminished. At noon he was aroused from sleep by blood in the throat, and when I reached him, fifteen minutes later, he vomited several large clots. He fainted from loss of blood, and was very anæmic; pulse 124 and weak. An application of Monsel's solution on cotton to the point where the blood was escaping (between the tonsil and upper part of posterior palatine fold) stopped the hemorrhage at once. Broths, beef-tea, and hot milk, all highly salted, were freely given at short intervals.

Forty-eight hours after the first hemorrhage, a similar one occurred and a large handful of clots was vomited. The bleeding was checked at once by an application of powdered alum. It was followed by great exhaustion, fainting, a feeble, rapid pulse and cold perspiration.

On January 2d and 3d similar severe hemorrhages occurred, and the situation of the child became exceedingly critical, notwithstanding the fact that he continued to take freely liquid nourishment and stimulants. In view of this it was thought that the time had come for operative interference, but for unavoidable reasons it was postponed.

On January 5th and 7th severe hemorrhages occurred and were promptly checked by the same application as before.

Fortunately, at the time of each hemorrhage, I was in my office and reached the house not later than fifteen minutes after the bleeding began. Hoping to secure some pressure on the point of escape, a piece of twine was carried through the right nostril by means of a small soft-rubber catheter and brought through the mouth. To this was attached a large wad of borated cotton, which was then carried carefully into the pharynx with post-nasal forceps and drawn firmly into the post-nasal chamber. No hemorrhage having occurred for forty-eight hours, the cotton was removed, but on removal there was slight oozing of blood, which was arrested by the usual measure. Applications of a weak solution of tincture of the chloride of iron were made every three hours, and an astringent spray was used hourly, hoping that by keeping up their continuous action the parts would be sufficiently contracted to prevent the blood forcing its way through the point of opening.

At noon a small lump in submaxillary region was discovered, which was considered a glandular swelling. At 4 o'clock it had increased, and by 11 P.M. there was a pulsating tumor 2½ inches in length by 1½ inches in breadth, extending from the mastoid process beyond the angle of the jaw, and with each pulsation the jaw and head were elevated. The temperature at the time was 101° F., pulse 108, feeble and small. He was in a drowsy condition, and for several hours had refused nourishment. The nature of the tumefaction appeared to me that of false aneurism, and the necessity of immediate ligation of the artery was impressed upon the parents.

To this they consented, and at midnight, with the assistance of Drs. Isaac Massey and William Sharpless, the operation was commenced. From the uncertainty of the situation of the bleeding point and the danger of further loss of blood from opening the tumor, ligation of the common carotid above the omohyoid was elected. The boy was given a few drops of chloroform to inhale, to avoid ether excitement, and anæsthesia then completed with the latter drug. After a thorough antiseptic toilet of the neck, the patient was wrapped in flannel and placed on his back, with head turned to left side. An incision was made, 2½ inches long, beginning a little below the angle of the jaw, along the anterior border of the sterno-mastoid muscle to a level with the cricoid cartilage. Careful dissection was made, and in a short time the artery exposed without injury to any important structure. A catgut ligature was used, and ends cut close to knot. After introducing catgut drainage, the wound was closed with silk sutures and dressed with iodoform and bichloride gauze. The operation was borne well, and with but little loss of blood. What did ooze was of a pale wine color. In fact, it was so watery that the structures could be seen through the little pool which formed in the wound. The pulsating tumor previously described decreased in one hour to one-half its former size, and in thirty-six hours was the size of an almond. Before daylight he took freely of hot milk and stimulants, and at 8 A.M. the temperature was 99° F., pulse 96, respiration normal. There was no difficulty or pain in turning the head.

January 11th the temperature was normal and there was no subsequent elevation. Recovery was rapid and uninterrupted. The wound united without suppuration and on the eighth day the stitches were removed.

The rapidity with which the child made blood was remarkable. It would have been interesting to note the record as shown by a hæmoglobinometer.

It is obviously impossible to determine the exact vessel involved in the ulceration, but from the character of the hemorrhages it must have been an important one. The abscess was deep-seated and was more a peritonsillar one than is usually seen.

My object in bringing this report before the College, is to call the attention of the Fellows to the youth of my patient and the unusual character of the hemorrhage. Parenchymatous inflammation of the tonsil is rare in children. In 1000 cases treated by Sir Morell Mackenzie[1] at the Hospital for Diseases of the Throat, there were only 35 cases under ten years of age. Dr. Beverly Robinson,[2] in speaking of the age at which deep-seated inflammation of the tonsil occurs in children, says: "I cannot recall a single instance in which I have seen suppurative tonsillitis in a small child." Dr. Goodhart[3] (quoted by Robinson) reports the case of a girl six years of age, who, when she came under his care, showed a large, deep ulcer, "which could," he thinks, "only have originated in acute suppuration of the tonsil." A case is reported by Norton,[4] in which the disease in a little girl four years of age terminated fatally from hemorrhage, the abscess having ulcerated into the carotid artery. Except this case, I have been unable to find an instance of the disease under the age of six years.

Two fatal adult cases have been recorded, the result of ulceration of the bloodvessels in deep-seated suppuration of the tonsil. Cayton's[5] patient, a man aged thirty years, of good constitution, had acute suppuration of the left tonsil. The abscess opened spontaneously during Cayton's absence, and the patient died suddenly. He had intended to open it on his return, and expresses great satisfaction that he had not done so—a feeling which I can heartily appreciate. The autopsy showed ulceration of the carotid artery. The patient of Müller[6] was a male, forty-four years of age, a farmer, always healthy. The trouble began with sore throat from cold, the tonsil subsequently becoming involved. The abscess opened spontaneously and there were nine severe hemorrhages in which between three

[1] Pharynx, Larynx, and Trachea, p. 37.
[2] Keating: Encyclopedia of Diseases of Children, p. 441.
[3] Diseases of Children, p. 105. [4] The Throat and Larynx, 1875.
[5] Annales de la Société méd. Chirurg. de Bruges, p. 196.
[6] Med. Correspondenz Bl., Würtemburg, 1853.

and four pounds of blood were lost. Intervals of several hours elapsed between the hemorrhages, as in the case herein recorded. The man died without operation, and the autopsy showed ulceration of the third branch of the carotid. Mackenzie[1] mentions a case related by Grisolle,[2] in which serious hemorrhage followed abscess of the tonsil. I have searched for a detailed report of this case in both the Library of the College of Physicians of Philadelphia, and in the Washington Army and Navy Medical Library, but the 1862 edition of his work is not in their possession, and the case is not mentioned in the editions of 1844, 1857, or 1869.

In none of these instances was there a resort to operation, unless it was in Grisolle's, a report of which, unfortunately, I have been unable to obtain. Through the kindness of Dr. Wise, of the Army Medical Museum and Library at Washington, I had access to the advance sheets of the *Index Catalogue*, and no record of other cases could be found. There are, however, on record a number of instances of abscess of the neck, in which life was saved by prompt operation. Dolbeau[3] relates the case of a girl, aged sixteen, with submaxillary abscess of right side, with perforation of lingual artery and successive hemorrhages. The external carotid was successfully ligated, and the patient recovered. Liston reports a case of submaxillary abscess with rupture of the carotid and sudden death.

Alarming hemorrhages have complicated operations on the tonsils. "McCarthy, in a case of excision of the tonsils followed by continuous bleeding, in the London Hospital, tied the carotid artery with success." Dr. Agnew[4] relates this case, and also states that the carotid artery has in several instances been injured by reckless and bungling operators. Velpeau (quoted by Agnew) records four cases of this kind.

[1] Loc. cit. [2] Traité de Pathol. Interne. Paris, 1862, t. i. p. 269.
[3] Bull. Soc. de Chir. de Paris (1864) 1865. 2 sér. t. v., pp. 180–187.
[4] System of Surgery, vol. ii. p. 991.

DISCUSSION.

Dr. J. Cheston Morris: I can confirm the statements of Dr. Dunn in regard to this case, which I saw with him in consultation. The first question that suggested itself to us was the possible cause of this inflammation, whether it could be due to diphtheria or scarlet fever. There was, however, no evidence of anything of that sort. We determined to continue the treatment which had so far succeeded in stopping the hemorrhage—that is, by styptics—although the question of operation was considered. At my second visit the hemorrhage was controlled by a tampon, and we noticed some swelling at the neck—and as I look back now I can recall that it was of a bluish color, which ought to have given us the idea of a hæmatoma. The hemorrhage, however, soon returned after the removal of the tampon, and Dr. Dunn proceeded to operate, and with success.

The only case at all similar to this, of which I know, was in a child under the care of my father, that was recovering from scarlet fever. About the fourth or fifth week of the disease, the child was apparently doing well, although it had an abscess on the right side of the neck, when suddenly the abscess broke into the carotid canal, and, pressing upon the pneumogastric nerve, produced instant death.

A NEW METHOD OF TENOTOMY, BY WHICH THE TENDONS ARE LENGTHENED TO A DEFINITE EXTENT, INSTEAD OF THE PRESENT HAP-HAZARD METHOD.

By W. W. KEEN, M.D.,
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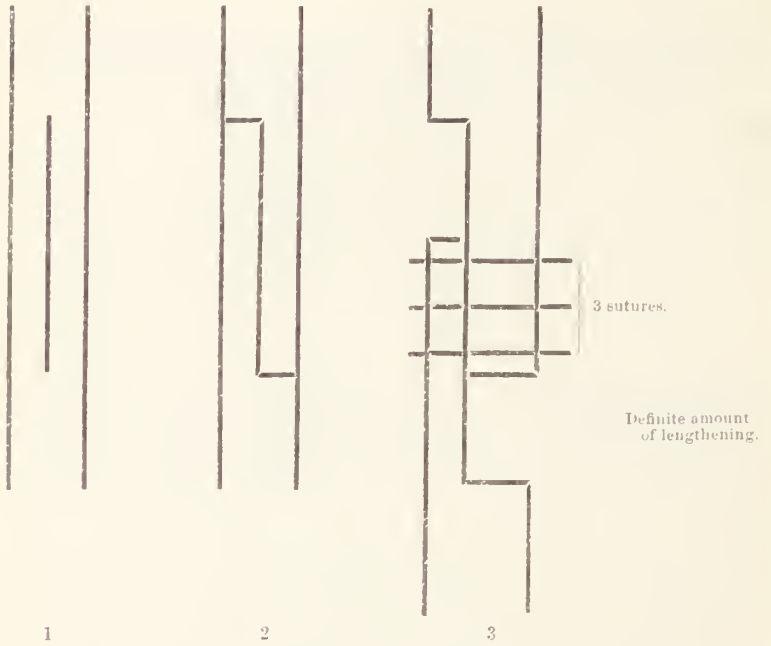
[Read March 4, 1891.]

I owe the suggestion which, I believe, I carried out for the first time anywhere, to the fertile mind of my friend, Dr. S. Weir Mitchell, who has adorned every department of medicine which he has touched. The case in which I operated was one of post-hemiplegic contracture of the flexors of the fingers, kindly sent me by Dr. John Van Bibber, of Baltimore. Dr. Van Bibber sent the patient to me for an opinion as to a possible operation of trephining for epilepsy, but I decided not to operate, as a careful investigation showed that the case was unsuitable. The fingers and thumb were markedly flexed into the palm of the hand, and Dr. Mitchell (who saw her with me) suggested that the contracture could be overcome by lengthening the tendons to a definite extent, instead of cutting them and allowing union to take place without any regulation of its amount.

The patient was a lady, twenty-five years of age. The following operation was done November 29, 1890. An incision was made, beginning just above the pisiform bone and extending three inches obliquely upward, its upper end being over the tendon of the flexor carpi radialis. The edges of the wound, when pulled to one side, very readily exposed all the flexor tendons. Each tendon was first split in the middle one and a quarter inches and then, at the two ends of this incision, section of the opposite halves of the tendon

was made. The two cut-ends were then slid past each other and sewed together for a distance of half an inch, making three-quarters of an inch of lengthening.



The tendons operated on were four of the deep flexors, five of the superficial flexors, the two carpal flexors, the flexor longus pollicis and the palmaris longus—thirteen in all. The flexor of the thumb was only lengthened half an inch, as I was fearful of losing its apposition with the other fingers if, in the shorter digit, the same amount of lengthening was done as in the long ones. Three stitches were taken in each tendon with fine chromic-acid catgut. The wound was drained with a few strands of horsehair and placed on a splint. Two small branches of the ulnar artery had to be ligated. No injury was done either to the median or ulnar nerve.

December 3. The night of the operation she had a severe epileptic seizure, during which the right hand was thrown violently about, and when the nurse seized it to protect it from injury it was still convulsed upon the splint.

6*th* (a week after the operation). Splint was removed, the operation-wound having entirely healed without incident. Whether, at the convulsive seizure, the tendons were torn loose, or whether they have been lengthened too much, I do not know, but I am rather inclined to the latter opinion. The thumb is still spasmodically flexed toward the palm, though by no

means to such an extent as formerly. The fingers have the last two phalanges in hyper-extension, and they cannot voluntarily be flexed.

12*th*. The forefinger has been for a number of years frequently spasmodically abducted toward the thumb, with cramping pains in its inter-osseous muscle. These have become rather more marked since the operation. The same tendency is noted in the other inter-osseous muscles toward divergence of all the fingers, but without much pain. I injected into the substance of the first inter-osseous muscle $\frac{1}{200}$ of a grain of atropine sulphate, with speedy relief.

19*th*. She went home to-day. Her hand is in much better condition, though she cannot yet flex the fingers to any extent. The tendons are not torn loose, inasmuch as in extension faradization flexes the fingers. The douche, hot and cold, and faradization with massage, are recommended.

Tenotomy heretofore may be said to have been a hap-hazard operation. The tendons once cut, the muscle retracts, and the gap, large or small, fills with fibrous tissue, and the function of the muscle is more or less well reëstablished. The method proposed, and carried out in this case for the first time, is, it seems to me, a decided improvement, as it makes the tendon longer *by a definite amount*. The difficulty, I think, will be to judge what is the proper amount. In the present case three-quarters of an inch seems to have been more than was wise, although possibly the function of the fingers may hereafter be improved more than is apparent at present. It is important, therefore, that whenever any other cases are operated upon in a similar manner, the amount of contracture to be overcome, and the correct amount of lengthening of the tendons to be effected should be studied, in order that we may reach a more exact conclusion as to how much the tendons ought to be lengthened. It is evident that the tendons are at first weakened, for such a tendon has only half of its substance left, but the two places at which there are short gaps will undoubtedly very soon be filled with fibrous tissue, and the tendon reëstablished in its full strength. That the reëstablishment of this full strength is very important, will be seen when it is considered that the strain on the tendo Achillis in standing on tip-toe is approximately three times the entire weight of the body, or 450 pounds for a man of 150 pounds' weight, as shown by Dr. A. B. Judson (*New York Medical*

Journal, August 23, 1890). The present method, I think, will better attain reëstablishment of the full strength of a tendon than the usual one.

Although with a different purpose entirely, yet something after the same fashion, namely, by splitting the nerve in half, Dr. Beach has reported in the *Boston Medical and Surgical Journal* of December 11, 1890, a method of uniting the two ends of a severed nerve.

DISCUSSION.

Dr. H. Augustus Wilson: I would ask Dr. Keen whether the method which he has described would not also be applicable to shortening the tendons as well as lengthening them.

Dr. O. H. Allis: Two years ago Dr. John Rhoades, of the Jefferson College, asked me if tendons could not be lengthened in the manner described by Dr. Keen, and I have been practising that upon the tendo Achillis, and have taught the class at the Jefferson College this method. It can be readily done on the larger tendons. I have never known a tendon refuse to unite, but I know that there are instances where a person has suffered from paralysis, and has a certain amount of contracture, and if it does not unite in such cases the limb is more helpless than before. I should adopt this method in that class of cases. In ordinary congenital club-foot I do not think there is any gain from this operation.

Dr. James Hendrie Lloyd: As I understand it, Dr. Keen has operated on a case of post-hemiplegic contracture. The cases of that kind that I have seen, where the contracture has been so great as to draw the fingers into the palm of the hand, have resulted in such a useless limb, that the question occurred to me, What special good could be done by simply lengthening the tendons and allowing the fingers to be extended? I should like to know whether Dr. Keen has observed that there was any improvement in the voluntary power following the operation. Contractures following hemiplegia are especially apt to affect the flexor muscles. Does the operation lead to any increase in power in the extensor group? Otherwise I can hardly see what practical benefit it would be to the patient. I refer only to post-hemiplegic contraction, and not to club-foot following infantile paralysis.

Dr. James Young: The operation spoken of by Dr. Keen is certainly unique, and I can imagine certain cases in which it will be of great service, but it must not be forgotten that all tendons heal by exudate from the sheath. The inflammation that follows section of the tendon does not heal it, but it is the secondary inflammation in the sheath. It is the plastic exudate from the sheath that joins the two severed ends of the tendon. A somewhat similar operation has been performed, and is spoken of as Reeve's operation.

The operation is subcutaneous, and consists in making an oblique incision through the tendo Achillis. I do not like to hear the operation performed by orthopedic surgeons spoken of as being done in a hap-hazard manner. After section of the tendon, the tendency is to correct, and rather over-correct, the deformity, and in this way the result anticipated is a definite one. The results are definite. Certainly in all contracture tendons we can look for a result that is definite, but in paralytic cases the deformity should not be over-corrected.

Dr. John B. Roberts: It is many years since I heard the late Dr. Levis speak of dividing tendons obliquely to prevent the ends from getting too far away from each other. I have done the operation for at least five or six years. Now to hear Dr. Allis tell how he went a step further, and made this angled lengthening subcutaneously, and then Dr. Keen coming and suturing the two together, affords a very interesting illustration of the advances made possible by aseptic surgery.

Dr. Keen: The suggestion of Dr. Wilson in regard to shortening of tendons by this method seems entirely practical.

As I understand Dr. Allis, he has done this operation subcutaneously and without sutures. It seems to me that this is exactly the difference between the two. It makes no difference whether the section is transverse, oblique, or angular, if we allow the muscles to contract as much as they will without definite fixation, it is still a hap-hazard operation. The muscles are allowed to contract to any extent that they will, and the part is retained in position by splints, and allowed to heal in a hap-hazard way, with no definite and predetermined amount of lengthening or shortening, as the case may be.

Dr. Lloyd has asked in regard to the usefulness of operations in post-hemiplegic contractures. I have done a number of tenotomies in such cases for Dr. Mitchell, and have obtained quite useful limbs in not a few cases. Even where the limb is useless the operation is of service as a cosmetic procedure, giving an open hand instead of the closed hand.

I am coming more and more to the opinion that all of our surgery with modern methods should be practically open wounds rather than subcutaneous. Perhaps that is rather strong to say all; but I think that a very large part of modern subcutaneous surgery should give way to the open method. The other day I had a patient at the Orthopædic Hospital, where I was obliged to sever the adductor muscles and the rectus femoris muscle in a contracted thigh. I divided subcutaneously all the parts that I could with safety, and yet the limb was still contracted. I, therefore, made an open wound in both places, and I found that at the internal wound I was within one-quarter of an inch of a large vessel, which would have given considerable trouble if it had been severed. Making the wound an open one, I was able to continue severing the muscles until I got the limb straight, and the wounds have healed without reaction. I do not believe in working in the dark where we can work in the light, and modern methods have given us the opportunity of doing this.

HAS THE PAROTID GLAND EVER BEEN EXTIRPATED?

By JOSEPH PRICE, M.D.

[Read March 4, 1891.]

On Tuesday evening, January 22, 1833, Granville Sharp Pattison, M.D., Professor of Anatomy in the Jefferson Medical College, Philadelphia, delivered a lecture on the subject of extirpation of the parotid gland. The occasion for that lecture was a statement made in 1832, at the Almshouse, by William Gibson, M.D., Professor of Surgery in the University of Pennsylvania, that "the parotid gland never has, nor ever can be extirpated." The students of Jefferson Medical College resented the assertion, inasmuch as their Professor of Surgery, Dr. George McClellan, had, shortly before the lecture delivered by Dr. Gibson at the Almshouse, in three cases removed the parotid gland, in one case in toto. Dr. George McClellan was the first, and in 1833 the only man in the United States who had performed the operation of total removal of the parotid gland.

Dr. Pattison, upon the cadaver, demonstrated the extirpation of the parotid gland, saying to his audience on that January evening: "You will never be told by a professor of the Jefferson Medical College that you ought not to attempt, yourselves, to perform the operation for lithotomy, but that you must send all your stone-patients to Philadelphia to be operated upon . . . . We expect so to teach you that you will unhesitatingly and fearlessly extirpate the *parotid gland*, and thus furnish a demonstration of the practicability and safety of an

operation, the possibility of which has been most positively and pertinaciously denied by the distinguished Professor of Surgery in the University of Pennsylvania."

Prior to and contemporaneously with the publication of Mr. Bell's *Anatomy*, numerous cases of removal of diseased parotid glands had been reported by the highest surgical authorities. Dr. Warren, of Boston, was the first in this country, in 1798, to perform the operation. Between 1808 (Bell's *Anatomy*) and 1829 many cases were reported by surgeons of high character; these reports do not admit of question. Prior to January, 1833, Dr. George McClellan, had removed the gland in three cases. His first case was in a Dr. Graham, of New York; the operation was performed in 1826. Sir Astley Cooper and Mr. Abernethy pronounced the operation one of entire removal. In Dr. McClellan's second case, in Mr. Sorber, a brother of Dr. Sorber, the operation was performed eighteen months after the first. The third case was in a male mulatto, in 1832. Dr. George McClellan performed extirpation of the parotid gland in eleven cases; ten of the patients recovered.

Some surgeons of note had already performed the operation prior to 1833. In 1733 a friend of Heister (vouched for by Heister) removed the parotid gland completely; Siebold (two Siebolds), Goodland (reported by Abernethy), Mr. Carmichael, and Béclard (recently Professor of Anatomy in École de Médecine, Paris), had each removed the gland in one case; Gensoul extirpated two, one in 1824, and one in 1826; Listranc extirpated one in 1826, and a post-mortem examination, made sixteen days later, in the presence of the French Academy of Surgery, proved to the entire satisfaction of the members of the Academy that every atom of the gland had been removed at the operation; Dr. Prieger reported three cases in which he removed diseased parotid glands. Sir Astley Cooper states, incidentally in a letter to Mr. Kirby, of Dublin: "I have removed the parotid gland twice within the last twelve months." Dr. Bush, of New York, performed the operation four times, with complete success, between 1827 and 1832.

Bérard's thesis, "On the Operations that are Demanded by

the Tumors Developed in the Parotid Region," written in 1841, marked an important phase in the history of tumors of the parotid gland. It is a *résumé* of the numerous facts demonstrated by his predecessors, and appreciates those facts at their just value; it is a precious document and establishes extirpation, and the results of extirpation, upon a sound basis. "Magna est veritas, et prevalebit."

Michaux, in his thesis for the degree of Doctor of Medicine, in 1883, says: "Attentive clinical observation is the basis of the greater part of the lustre and *éclat* of the French School of Surgery, although pathological and histological anatomy have made immense progress, and added to our surgical knowledge."

Pattison says: "The study of surgical anatomy has caused the glorious successes in surgical operations."

"Observation is sufficient," says Delorme. "There are two points of view—that is to say: 1. Extirpation; 2. Study of the tumor—in parotid operations."

It is a great work to read the reports of the various authors on "cancer of the parotid." S. Duplay, in his *Traité de Pathologie Externe*, states that of fifty-two cases in which Bérard performed extirpation of the parotid gland, in five or six the operation was performed for the removal of carcinoma. Duplay also cites the following: 2 extirpations for cancer of the parotid by Bauchet, 1 by Robert, 1 by Gosselin; and 8 or 10 others in foreign and French journals.

About 1820 the first good descriptions of tumors of the parotid, especially of cancers, appeared. Most of the confusion about tumors of the parotid gland arises from use of the word *scirrhus* for all hard tumors. Sabatier gives good descriptions of scirrhus. Vidal de Cassis wrote of true cancer. Broca published an article on "Adenoma." Dolbeau wrote a memoir on "Enchondroma of the Parotid." Discussions in the French Surgical Society, participated in by Huguier, Gensoul, Chassaignac and others, demonstrated that *epithelioma* of the sudoriferous glands existed together with a similar variety of tumor of the parotid. Bauchet wrote upon hypertrophies of the

parotid gland. The treatises of Nélaton, de Follin and Duplay, Billroth, Paget and Gross, carefully read, will give all the clinically diagnostic points of carcinoma of the parotid.

Planteau, in 1874, described mixed or complex tumors of the parotid gland.

Michaux, in 1883, in his thesis on "Carcinoma," says: "Cancer is rare in the parotid;" again: "Most parotid cancers are encephaloid; but one or two are scirrhus." In preparing his paper he verified all the French cases reported between 1872 and 1883. Dr. Bar did the same for the English, American, and German cases reported during the same period. He says: "The surgeon must not lose sight of the fact that benign tumors are transformed into malignant."

Velpeau calls attention to points of similarity between cancer of the breast and cancer of the parotid gland. The topographical relations and lymphatic connections of the parotid gland should be closely studied by any surgeon contemplating its removal. Malignant tumors develop principally in the posterior and inferior portions of the parotid region. An aponeurosis between the digastric and stylo-hyoid muscles forms a barrier between the parotid and submaxillary glands, that tumors rarely cross; the same is not the case with the facial aponeurosis of the sterno-mastoid. The "accessory parotid" consists of lobules partially or completely separated from the body of the gland, lying beneath the zygoma, and is by some believed to be the seat of the pathological changes in this region. Tumors of the parotid often appear to originate in the lymphatic glands imbedded in its substance.

Michaux, in Chapter IV. of his work on *Etiology*, says: "It it impossible to separate the etiology of cancer generally from that of scirrhus, and that of encephaloid of the parotid from that of epithelioma." There are primitive and consecutive cancers. Little is known of the cause of primitive cancer of the parotid. Michaux also alludes to the age at which it occurs; to its appearing earlier in women than in men, "at least to its quick growth of transformation"; to scirrhus appearing later

than encephaloid; to the more rapid growth of diffused scirrhus; to its being more common in men; to its evident heredity; to Verneuil's case of parotid cancer coexisting with diabetes; to the urine of patients with atrophic scirrhus containing no sugar. He further says: "many of these things remain to be proved." The symptoms of tumors of the parotid gland are: (1) functional, and (2) physical (deformities). If the tumor be a scirrhus, paralysis of one nerve sometimes occurs before the tumor is appreciable. The auditory functions are often decidedly interfered with; there are perceived cutaneous sensations, tickling and heat. Encephaloid, if in the centre of the gland, is in its early stages deceptively mobile.

Richet gives the following sign of malignancy: if a bistoury be stuck into a benign tumor, the prick easily heals; if the tumor is malignant, the opening enlarges and discharges fluid.

The duration of carcinoma of the parotid gland is given as from two months to five years (Michaux).

In 1881 Defosses suggested the epithelial origin of cancers; Klebs, Rindfleisch, Rudolf, Maier, Birsch-Hirschfeld, Thin, Creighton and others also entertain the possibility of the epithelial origin of cancers of the parotid, and the conversion of the stroma into epithelium by infection.

According to Creighton's theory intra-acinous proliferation gives rise to medullary cancer; extra-acinous proliferation to scirrhus.

Billroth has advanced the idea that fibromas are converted into sarcomas, and that primary sarcoma is rare.

William Hunter was the first to point out the true character of fibroma—it is his "fleshy tubercle."

S. W. Gross states that between sixteen and forty years of age the order in which tumors are common is as follows: fibroma, sarcoma, adenoma, carcinoma and myxoma; after forty years in the reverse order—that is, myxoma, carcinoma, adenoma, sarcoma and fibroma; hence atrophy and decay predispose to myxoma and carcinoma. According to Virchow, there is a parallelism between fat and mucus and similar tissues; that

may account for the mixed character of some tumors of the parotid gland as well as of other tumors.

It is useless to speak at length of the development, growth and evolution of tumors of the parotid, because about all that can be stated is theoretical. Adenoma and epithelioma are difficult to distinguish. Sarcoma is more difficult to diagnosticate. Some sarcomas grow rapidly and ulcerate early; ganglia are rarely involved; there is no cachexia; the tumor is mobile at first, little fixed, little adherent, spreads little to adjacent regions; it behaves to the bistoury as does carcinoma. Cartilaginous, fibrous, cystic and sarcomatous tumors are movable. Enchondromas make as slow progress as sarcomas; they are not always histologically pure, but are generally mixed with sarcoma or myxoma; they are complex by nature and uncertain in progress (at first, stationary and benign; secondly, they suddenly and rapidly increase and modify structure); the skin may be invaded; ganglia may be involved; pain and paralysis of the face may be accompaniments. Pure forms of parotid tumors are rare; combinations of pathological variations are the rule. The most frequent are the enchondromas.

William Goodell, of Philadelphia, writing on "Inflammation of the Parotid Glands following Operations on the Female Genital Organs," says: "Kinship, close between the sexual organs of adults and the cervical and salivary glands, has long been observed. Salivation is often a phenomenon of pregnancy." The thyroid gland frequently swells after marriage, during menstruation and during pregnancy; hence Meckel regards it "as a repetition of the uterus in the neck." Metastasis from mumps to the sexual organs in adults of both sexes —to the testes, ovary, breast, womb, labia—frequently occurs. Puerperal fever is liable to give rise to parotid bubo. An incision in the posterior cervical region has been followed by suppuration of the parotid gland and fatal septicæmia. Parotid bubo is liable to follow ovariotomy; in Schroeder's 200 cases of ovariotomy, reported by Möricke, there were 5 cases of parotid bubo, with 2 deaths. In 154 cases of ovariotomy by

Goodell, there was 1 parotid bubo; the left ovary had been removed; the patient died. Keith, in 500 ovariotomies, had 2 cases of suppurating bubo. Goodell alone, in his paper of 1885, reports from 15 to 21 cases of metastatic parotid bubo; nearly one-half died. R. B. Mowry, in 1882, and others mention bubo of the parotid gland in association with typhoid fever, atonic dyspepsia, influenza, smallpox, typhus fever, septicæmia, lithotomy, circumcision, gastrotomy, operations about the vermiform appendix, hysterectomy, penetrating wounds of the abdomen, Bright's disease and compound fracture of the ilium. In the plague all the glands inflame.

A. J. Cribb, in 1886, speaks of the catheter and of the pessary causing suppurating parotid bubo.

A. Harkin, in 1886, quotes Professor Möricke on the well-known relation between the testicle and the parotid gland.

S. Paget suggests a connection between the glands at the commencement of the alimentary canal and the membrane covering the remainder of the canal.

Darwin says the odoriferous glands of various animals enlarge in the breeding season.

F. T. Tayler says that in *children* the sexual organs are imperfectly developed; hence these organs do not suffer in mumps.

Orchitis following mumps is common.

Metastatic parotiditis occurs when the peritoneum is not involved, as in: *a.* Excision of the cervix (Goodell); *b.* Repair of a laceration of the cervix (Emmet); *c.* Repair of a vesico-vaginal fistula (Emmet); *d.* Lithotomy and circumcision (S. Paget); *e.* Medical cases, as in typhus and typhoid.

Glandular, proliferous cysts are by Sir B. C. Brodie called "sero-cystic sarcomata." Some cysts are formed by the dilatation of a duct; some through the transformation and enormous growth of some elementary structure of the gland. The walls of cysts are apt to be œdematous, succulent, almost gelatinous. Vascular growths may spring from the inner surface of a cyst-sac, and continue to grow, and hernia ensue.

Salivary calculi constitute a cause of retention-cysts of the parotid. The calculus should be sought in the duct.

Epithelioma of the pharynx sometimes extends secondarily to the parotid.

One case of rhabdomyoma of the parotid gland is reported by T. Mitchell Prudden, M.D., of New York. Such cases are rare and complex; rhabdomyomata occur in the genitals and in the kidneys; their character and occurrence were adduced by Cohnheim in support of the suggestive theory of the embryonal origin of tumors. The case of Prudden lends weight to the theory of Cohnheim: first, because the tumor was complex and seated in the genito-urinary tract; second, because it was situated near the seat of embryonal gill-clefts.

Bancroft reported, in 1860, a fatal case of parotiditis. Epidemics of mumps occur, as do epidemics of erysipelas of the parotid gland, with metastasis to other organs.

As to the classification and frequency of tumors of the parotid gland there has always been great confusion. Gross gives a table, based upon microscopic examination of the tumors, in which the arrangement is as follows: Chondromas, 28; carcinomas, 26; fibromas, 6; encephaloids, 9; epitheliomas, 10; scirrhus, 7; fibro-myo-chondromas, 20; cystomas, 5; melanotic adeno-sarcomas, 4; sarcomas, 3; and myxomas, 3.

Four cases of hydatids of the parotid gland have been reported; nor is it to be forgotten that Vernenil has reported gumma of this gland.

The diagnosis is important in so far as it concerns the question of extirpation or of evacuation as an operative procedure. Further than that, the size, the paralysis, the interference with circulation, breathing, deglutition and speech are the determining factors in extirpation. There are many elaborate tables of differential diagnosis that may be found for reference by those who need them. Rarely is it determined before operation whether the whole or but a part of the gland is diseased, though an examiner be never so skilled in clinical pathology and diagnosis. If the tumor is malignant recurrence of the growth may be expected in from three to six months.

In the prognosis of carcinoma it is most important to remember the fact, that *if left in situ*, there is but one constant termination—*death*, which does not always occur at the same time.

The treatment of the tumors that are persistent and increasing in size is to be considered under two heads: 1. Extirpation, surgical; 2. Alleviation, medical. Complete extirpation of scirrhus is successful, says Boyer. Richet says abstain. Tillaux says: "Do not attempt operation; it is worse to kill than to allow the patient to die." Gosselin says abstain absolutely. Duplay says the same. Trelat states that "extirpation is necessarily incomplete; there is trouble during and after extirpation; hence abstain." Hippocrates thought that "if we treat them, they die quickly; if we do not treat them, their life is prolonged." S. W. Gross advises early and complete removal. Ambrose Paré says: "The office of a good doctor is to cure disease; if he does not reach that end, at least he must soothe it."

The operations that have been performed in the treatment of diseases of the parotid gland are: 1. Compression; 2. Puncture; 3. Incision; 4. Extirpation; 5. Cauterization—chemical, actual; 6. Ligature, etc.; 7. Injection (iodine usually).

Chopart and Desault cauterized. Kyll ligated. Topical remedies were used by our ancestors. Internal treatment is not of any use. Injections of iodine fail. J. Morrison uses tincture of iodine by injection and by internal administration. Compression is of no use in cancer, though said to have been effective in enchondroma. The wire écraseur has been used. *Extirpation by the knife is the only radical operation.* Hæmostatic measures are necessary.

There are two considerations to be weighed: 1. The operation; 2. The disease. If operation be decided upon, it is to be determined: *a*. Can it be done? *b*. When should it be done? *c*. What method of operating is to be preferred?

Velpeau casts doubt on all extirpations in which there was no great hæmorrhage and no paralysis, or in which movements of muscles were restored after operation—*i. e.*, after being lost.

Malgaigne, in 1858, admitted that in exceptional cases the parotid gland may be removed without wounding the external carotid artery or the trunk of the facial nerve, and the Imperial Academy of Medicine sustained his conclusions.

Naegele states that he removed the parotid gland in the living without wounding the trunk of the facial nerve, and without causing paralysis.

Heyfelder says that the growth of the gland may by pressure obliterate the artery or diminish its size.

Fergusson states that he divided the facial nerve, but that the paralysis after a time diminished.

Hystern is quoted by Velpeau (quoted by D. W. Bliss) as having removed the body and the condyle of the lower jaw, the surface of the mastoid process and the glenoid cavity of the temporal bone, and having scraped the tubercle of the temporal bone, with ultimate recovery on the part of the patient.

Dr. George McClellan, who performed the operation eleven times, said that it is easier to remove the gland in the living than in the dead. Since the time of Béclard over fifty operations of undoubted total removal could be quoted. Professor Wermhold, of Halle, performed extirpation three times. Harris, of Philadelphia, removed the gland entirely once. Agnew did it five times. James E. Garretson has done it. Joseph Price has done it oftener than any living man—that is, six times. In all of the 91 cases analyzed by Dr. Brainard, of Chicago, extirpation is believed to have been complete, while but 12 of Professor Burn's collection of 167 cases were total extirpations; 109 were but partial, and 46 almost total. About 150 total extirpations are reported.

Doubt is entertained that all these cases are complete extirpations: first, because the cavity left is not well described; secondly, because a fistula is left; thirdly, because some gland tissue is found in a recurrent tumor. There have been surgeons in our own day who have denied the possibility of total extirpation of the parotid gland; this is of small matter; it is said that every medical man over forty years of age refused to

accept the circulation of the blood when it was demonstrated by Harvey. There are fossils in every age.

Let it be repeated that the operation for complete removal of the gland is difficult, and requires the profoundest knowledge of anatomy and consummate skill. Diseased glands are easier of removal than healthy ones, because of their denser, better-defined capsule.

The best position for removal is with the patient resting on the sound side, with the head and shoulders elevated.

The incisions may be curvilinear and obliquely downward, crucial, elliptical or T-shaped. The important point about the incision is that it be large enough.

The surgeon must avoid the internal carotid artery, the jugular vein and their accompanying nerves.

The gland is preferably to be lifted out from below upward; in this way the smallest quantity of blood is lost.

The inflammation following the operation is often severe, gives great anxiety, and requires the closest care.

Paralysis of the corresponding side of the face always follows the operation; it may wholly or partially disappear in time. It is the motor branch of the seventh nerve that is injured in these cases.

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DISCUSSION.

Dr. John B. Roberts: This is an interesting subject. I hardly like to discuss it, although I think the paper should not go out without some discussion. I am not convinced that the cases reported were excisions of the parotid gland. Not having seen the cases, it is impossible to say, for Dr. Price has not given us sufficient details to enable us to determine whether or not these were complete extirpations of the parotid gland. I wish that Dr. Price would, at some future time, give us a little more in detail the conditions under which he operated and the anatomical facts which led him to believe that he had removed the entire gland. The operator can often, by the appearance at the time, be absolutely certain that he has accomplished a particular thing. When a case is reported without any detail, it is impossible for the Fellows to discuss it with the absolute anatomical certainty with which we should discuss such subjects.

GONORRHŒAL EPIDIDYMITIS.

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AND

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[Read April 1, 1891.]

Epididymitis, the most frequent complication of gonorrhœa, commonly develops in the third, fourth, or fifth week of the urethral inflammation, that is, at about the period when the posterior urethra becomes involved. Cases are reported in which the epididymis was attacked within the first few days of a urethritis. Since a gonorrhœal inflammation, so rapid in its extension as to reach the posterior urethra in this short time, is most exceptional, we believe there must be some peculiar circumstance to account for this unusual course. In one case of our own an epididymitis was seen within a week after the appearance of a first attack of gonorrhœa. On careful examination, a history of local injury, inflicted *in coitu*, was elicited. We saw another case develop epididymitis three days after the appearance of the urethral inflammation. This was, however, occasioned by the passage of a sound which, by carrying the microörganisms to the ejaculatory ducts, acted as effectively in starting the inflammation along the vas deferens as would the development of the posterior urethritis.

As long as there are any traces of a posterior gonorrhœa, it is possible that the inflammation may be carried in an acute form along the cord. Fournier cites cases occurring four years after the attack of gonorrhœa.

Authors differ greatly in their statements as to the frequency of epididymitis. Rollet found that out of twenty-five hundred cases of urethritis the epididymis was involved in about 27 per cent. Finger observed this complication in 30 per cent., Phillips in 15 per cent., Fournier in 12.5 per cent., Tarnowsky in 12.2 per cent. Since the majority of these figures are the result of analysis of hospital cases, it is probable that they are misleading, as nearly all patients afflicted with epididymitis are forced to seek medical aid, while a very large number pass through all the stages of an acute gonorrhœa practically without treatment. A surgeon who, in his private practice, had one patient out of every three, or even out of every ten, suffer from involvement of the epididymis, would certainly not be satisfied with his results.

In relation with prophylaxis, the causes which favor extension of gonorrhœal inflammation to the epididymis merit careful consideration. Of all these, we believe the most potent is the neglect of treatment, especially when combined with bodily activity. Of the cases which have come under our observation, the very great majority have received no treatment, either local or by the mouth; a few have put themselves in charge of accommodating druggists. Le Fort (quoted by Finger) found that of 576 cases 264 had received no treatment, while only 60 gave a history of having employed balsams and injections.

The effect of violent and prolonged muscular exertion is well shown in the history of the following case:

A., student, acquired gonorrhœa at the age of thirteen. He applied no treatment to this, though he suffered greatly from ardor urinæ, chordee, and profuse discharge. At the end of four weeks, though his symptoms were still severe, he played a Thanksgiving game of foot-ball, being captain of his school nine. Within the next three days both testicles became acutely inflamed. The constitutional symptoms were especially marked, the patient remaining delirious for two weeks. At the end of that time he slowly recovered. There was still a profuse bloody discharge from the urethra. This ran into a gleet, which lasted one year, and then underwent spontaneous resolution.

Sexual excitement is, perhaps, next to neglect of treatment, the most important factor in determining the extension of

gonorrhœa along the vas deferens. On this point it is often difficult to elicit a satisfactory history. In one of our cases, who suffered from three attacks of inflammation of the epididymis recurring at short intervals, and who persistently denied venery as a cause, it was subsequently proved that all his attacks immediately followed sexual excess. The inflammation of the posterior urethra in itself engenders an erythism manifested by persistent erections and by frequent emissions, resulting not merely in long-continued congestions, but mechanically favoring the entrance of gonococci into the ejaculatory ducts.

Any pathological condition, such as varicocele, displacement, contusion, or congestion, seems to predispose to involvement of the epididymis in the gonorrhœal process.

A weak constitution, such as is found in strumous patients, or such as is developed by continued fevers, lack of exercise, excesses, or bad hygiene, strongly predisposes to the development of epididymitis. While we have seen gonorrhœa expend its force with explosive violence upon the sanguine and robust, it is particularly weakly persons, exhibiting symptoms of moderate intensity, whom we watch for the early signs of testicular trouble.

The disease is usually unilateral, and seems, according to Julien, to have no special predilection for either side. Sigmund, however (quoted by White), found in 1342 cases that the left testicle was affected in 66 per cent. The inflammation usually expends its violence upon the tail of the epididymis, though both the head and the body may be involved. There is an acute catarrhal condition with involvement, not only of the epithelium and the walls of the ducts, but also of the surrounding cellular tissue. There is an abundant round-celled infiltration, and, on cross-section, small cavities filled with a puriform liquid have been frequently noted. These are dilated portions of the ducts.

The testicle is very rarely involved; the tunica vaginalis, however, nearly always participates in the inflammation, a plastic or serous exudate being thrown out, frequently in considerable quantity. The loose cellular tissue surrounding the cord and covering the portion of epididymis not included

in the reflection of the tunica vaginalis also becomes greatly infiltrated, completely masking the epididymis proper and rendering exceedingly difficult any just estimate as to the amount of enlargement.

As the inflammation subsides, the greater portion of the inflammatory exudate undergoes resolution; a certain part, however, organizes into fibrous tissue, which may produce a general hardening of the organ, or may form distinct nodules. In the latter case the induration is most frequently found in the tail of the epididymis, and at times occasions obstruction to the duct. Thus Gosselin reports several cases in which, on dissection, the lower end of the epididymis was found obliterated in a mass of dense fibro-cellular tissue, apparently resulting from previous inflammation. There are, however, many recorded cases where, with marked induration, there was no obstruction, and, *per contra*, other instances are noted where, without induration, the passage of the spermatozoa was entirely prevented. Should suppuration take place, however, there is liable to be an extensive destruction of the tubular elements of the epididymis.

Even should obstruction to the efferent duct or the vas deferens result, atrophy, or even marked change in the testicle, does not necessarily follow. Curling and Gosselin adduce several observations in which there was obliteration of the duct in the tail of the epididymis, without alteration in the normal appearance of the glands. Hunter, Gosselin, Brugnane, and Bosscha all observed cases in which there was a break in the continuity of the vas deferens from congenital malformation; notwithstanding this fact, the testicle was normal in size and appearance, and in some instances contained spermatozoa. Cooper divided the vas deferens of a dog, keeping the animal for six years, during which time he was seen twice *in coitu*. The testicle was found enlarged, and the portion of the deferens attached to the testicle was much distended with semen. Gosselin observed a man who suffered from orchitis and atrophy of one testicle and from gonorrhœal inflammation of the other. Twenty-five years later no sper-

matozoa could be found in his semen, though repeated examinations were made and the ejaculation was encouraged by natural stimulus. Subsequently an encysted hydrocele developed. It was tapped and was found to be swarming with spermatozoa.

These facts evidently show that the testicle is not amenable to the laws governing other glands. It would not seem credible that after complete obliteration of the efferent duct for many years, the glandular structure of the testicle should maintain its health and activity, were this not abundantly confirmed by clinical evidence.

The symptoms of gonorrhœal epididymitis are usually inaugurated in patients of the better class by dull, dragging pains in the groin, particularly noticeable on standing or walking. This pain may be darting or shooting, may radiate from the groin down the thighs into the rectum, or in various directions, and may even become so violent as to simulate the suffering incident to an acute strangulation of the gut. At times enlargement of the vas deferens or the cord may be distinctly felt at the point where the latter passes from the external abdominal ring.

In a few hours, or at most one or two days, unless the extension of the process is arrested, the symptoms of acute inflammation will become manifested about the epididymis. The body of the testicle is at first perfectly normal; the epididymis seems to become almost immediately enlarged to a very great extent. This tumefaction is in reality due mainly to infiltration of the loose cellular tissue involving the posterior upper border of the epididymis and continuous with the tissues of the cord. The skin of the scrotum becomes hot, red, and œdematous. Koenig states that this œdema is particularly characteristic of epididymitis. The pain is sickening, intense, wearing, constant; tenderness is exceedingly well marked. There is quickly an effusion into the tunica vaginalis; this may be limited in quantity to a few drops, and may be confined to the neighborhood of the epididymis by adhesive

inflammation, or there may be a quantity so considerable that the testicle is entirely concealed.

Inflammations of every grade of intensity are observed; at times the symptoms are so slight that the patient complains only of a dragging sensation and the mechanical discomfort of the swelling. Again, the violence of the inflammation may run the temperature to 105° F., while the pain and tenderness may produce complete prostration. Coincident with the onset of the inflammation frequent emissions take place, the semen at times being blood-stained, more frequently of a yellowish or greenish hue.

In six to eight days the disease has passed its acute stage; the temperature usually drops to normal before this. In two or three weeks the swelling has disappeared, leaving a somewhat hardened, nodulated epididymis. Relapes are, however, frequent, and the first attack seems to predispose to others.

The prognosis of gonorrhœal epididymitis is, in so far as the acute symptoms are concerned, always good. Cases of peritonitis resulting from extension of the inflammation along the cellular tissues of the cord, or of septic poisoning consequent upon abscess formation, are so rare at the present day that they can well be considered as surgical curiosities. Even should suppuration take place, resolution after evacuation of pus is practically assured, though troublesome sinuses may remain for a long time.

Atrophy of the testicle has at times been observed and has been attributed to obliteration of the lumen of the vas, or the convoluted tube. Since autopsy records, experiments and clinical observations have abundantly proved that such obstruction is not followed by any appreciable change in the testicle, it is evident that another cause for the occasional wasting must be sought. This may depend either upon involvement of the testicle in the original inflammation with subsequent sclerosis, or in obliteration of the vascular supply by cicatrical contractions.

Although obliteration of the ducts does not necessarily produce wasting of the testicle, it inevitably prevents passage of

the spermatozoa, and, if the obstruction occurs on both sides, results in sterility. This sterility is not accompanied by impotence, and usually there is not even impairment of sexual power. The ejaculated fluid contains all the elements of normal sperma except the spermatozoa. At the time of ejaculation there may be experienced a dull pain in the testicle, though this is frequently not noticed.

It is of vital importance to determine with what frequency this obliteration remains as a permanent result of epididymitis. Nearly all authorities are agreed upon the point that double epididymitis results in incurable sterility in the great majority of cases. From this would necessarily follow the corollary that epididymitis of one side nearly always cuts off the secretion of the involved testicle. Since there is no characteristic change in the organ as the result of obliteration, evidence on the subject is hard to find. It can only be obtained by examining the semen of patients who have had double epididymitis or of patients who have had epididymitis in their one secreting testicle. Thus, Axford reports a case of epididymitis occurring in the right testicle, the left never having descended. On recovery from the acute attack the semen was without spermatozoa, though there was unimpaired virility. Induration of both globus major and globus minor was marked. After a two months' inunction of resolvent ointments, spermatozoa again appeared. Here it is evident that obstruction was temporary, since there was but one secreting testicle.

Gosselin examined the semen of fifteen cases of comparatively recent double epididymitis, all showing callosity in the globus minor. All were possessed of full virility—in none were spermatozoa found. All but two cases disappeared; these two were treated for some months, as a result of which spermatozoa reappeared coincident with the resolution of the induration of one side. Five other cases of long standing consulted him; in one there was no callosity on the left side, and spermatozoa were found. The other four exhibited hardening on both sides, and no spermatozoa could be discovered.

Godard records five cases of double epididymitis. Three were comparatively recent. In two, after some months, the spermatozoa again appeared in the semen. The third case disappeared. Two cases suffered from double epididymitis many years before, and consulted Godard for the resultant sterility.

Liégois observed twenty-eight cases of double epididymitis, in seven of whom spermatozoa again appeared some time after the subsidence of the acute process; in two of these cured cases there remained induration on both sides. Of the cases in which sterility resulted there was a number in which no induration could be detected. It was noted that all the cases in which the spermatozoa again appeared exhibited a mild form of the disease, and in some the history of preceding acute inflammation of the urethra was not clear.

Godard states that sterility nearly always results from an attack of double epididymitis, since of thirty-five subjects attacked spermatozoa were absent in the ejaculation of all. Gosselin, Curling, Terrillon, and the majority of genito-urinary surgeons are of the same opinion. This belief seems to be thoroughly substantiated by statistical study, since White states that of 117 cases of this character collected from various sources, only thirteen are recorded as experiencing any improvement from treatment.

We believe that the results of a study of reported cases are misleading. A person suffering from double epididymitis disappears after two or three weeks of medical treatment. Provided no further local trouble develops, he will give little thought to the condition of his testicles. Still less will he be liable to consult a surgeon years after, should he marry and become the father of healthy children. Should he fail to procreate, however, in his many inquiries as to possible causes for this, he will soon learn the alleged effect of inflammation of the testicles, and will promptly report for medical attention. Hence, the sterile cases nearly always seek medical advice, whilst those in whom the ducts remain patulous are not observed.

It has been shown that a sterility of months or even years may disappear under treatment. Hence, observation of patients immediately after an attack of double epididymitis is not sufficient to settle the question of permanent crippling.

It should be noted that of Gosselin's fifteen cases only two remained under observation, and that in both of these cases spermatozoa reappeared. Two recent cases treated by Godard also entirely recovered. Fournier believes that complete restoration may take place in a much larger number of cases than is generally conceded.

Our own experience suggests that the prognosis in double epididymitis is distinctly favorable. We have examined the semen of four cases.

The first, a case of double epididymitis of unusual violence, occurring at the age of thirteen, has been already described. Ten years after this attack no induration of either epididymis could be found. The semen was swarming with active spermatozoa.

The second case, a man, aged thirty, under treatment for acquired syphilis, suffered from a severe attack of double epididymitis ten years ago. He has had no trouble referable to the testicle since. Slight induration of the epididymis of each side was noted on examination, There were no nodules. The semen was swarming with active spermatozoa.

The third case, a man, aged twenty-four, suffered from gonorrhœa seven years ago. This recurred frequently. Three years ago he had a swelled testicle (left) after passage of sounds; shortly after this he married, and is now the father of a healthy boy. One year ago he came for treatment on account of swelling of the right testicle; this, he said, was occasioned by a blow. The cord was greatly thickened and there was urethral discharge. The swelled testicle underwent prompt resolution, but a large induration was felt in the globus minor of each epididymis. Four months later his semen was examined; no spermatozoa were found. Under resolvent treatment the nodules of induration have steadily decreased in size; they have not yet disappeared, nor is there a return of the spermatozoa, though the case cannot yet be regarded as hopeless. The last microscopical examination was made a little short of one year after the inflammation of the right epididymis.

The fourth case, a man of about thirty years, was under treatment for acquired syphilis. He has suffered from gonorrhœa many times. Fourteen months ago, after passing a sound, acute epididymitis of the right side developed. This confined him to bed for about a week. Six months later, consequent on excessive venery, the left epididymis became inflamed. This

confined him to bed for ten days. At the time of reporting he was suffering from gleet. The globus minor of each epididymis was indurated.

Examination of his semen showed it scanty in quantity, but containing many spermatozoa—some deformed, but the majority of perfect shape. They were not, however, so numerous as is usually the case with healthy individuals.

We examined the semen of two other cases, who, many years before, suffered from double epididymitis. In both there was entire absence of spermatozoa. Both sought medical advice, because after marriage no children had been born.

From this very limited experience it would seem that not only is there a chance that the ducts may become patulous, but there is a strong probability that this result will take place in the majority of cases.

It has been claimed that epididymitis of one side causes a disappearance of spermatozoa during and after its active stage, and is not infrequently followed by permanent sterility. Liégois examined sixteen subjects suffering from unilateral epididymitis. Thirteen were examined immediately after the disappearance of acute symptoms. Very few spermatozoa were found in twelve. In three subjects spermatozoa were very infrequent for some time after cure. Hirtz states that he has seen several instances of permanent sterility resulting from unilateral orchitis. Duplay and Gosselin found, upon post-mortem examination, that the obliteration of one epididymis was at times characterized by absence of spermatozoa in both testicles.

We have but one observation upon this point:

A stout young laborer presented himself with the symptoms of acute epididymitis. Under treatment he was practically well in two weeks. At this time his semen was examined. Very few spermatozoa could be found, certainly not one-thousandth portion of the number normally present. Two months later the semen was again examined. Twenty-four hours after ejaculation it was found to be swarming with active spermatozoa.

We have no explanation to offer as to why an inflammation of one side should seriously affect the function of the other testicle.

In regard to the treatment of gonorrhœal epididymitis, we believe that much can be done to prevent the appearance of this serious complication. The avoidance of all causes which tend to exacerbate the posterior urethritis, particularly irritating injections, instrumentation, excesses of any kind, or a full rectum or bladder, is universally advised. The wearing of a suspensory bandage is also warmly commended.

Probably the most effective preventive is the continued use of antiseptics by the mouth. Of these various combinations, the most satisfactory in its results is that suggested by White. Four to six capsules are given daily, each containing five to ten grains of salol, together with copaiba, cubebs, and pepsin.

As the epididymis is only reached from the urethra by means of the vas deferens and cord, the inflammation must necessarily pass along these structures, and may be expected to exhibit characteristic symptoms before it has reached the testicle. As a matter of fact such symptoms are nearly always present. The dragging pain in the inguinal region of the affected side, together with tenderness and increased resistance along the cord, shows in what direction the inflammation is travelling. Prompt treatment may save the epididymis, the case not proceeding further than a funiculitis. One such case we have observed, and a number of similar ones have been reported. In the case we treated the epididymitis was aborted by immediately placing the patient in bed, applying active counter-irritation to the skin of the inguinal region, and elevating the testicle.

When the disease is fully developed, we believe that a proper selection, from the innumerable methods of local and general treatment advised, can readily be made. Locally the application of a modification of the Langlebert-Horand suspensory bandage, supplemented in severe cases by incision into either the tunica vaginalis, or the distended cellular tissue back of the epididymis and above it, will almost immediately subdue pain and secure a rapid resolution of the symptoms of acute inflammation. A continuance of the same dressing,

with the application of mercury and belladonna ointments, will produce prompt disappearance of fibrous nodules. Constitutionally the administration of any bland fever mixture in the acute stage, followed by small doses of iodide of potassium till induration disappears, is all that is required. Of course, the bowels must be kept soluble, and the urine should not be allowed to become strongly acid.

Medicines, such as pulsatilla, which have been vaunted as specifics, have, on extended trial, been found to be utterly useless. The good effects attributed to this drug are probably due to the fact that epididymitis of itself not infrequently runs a mild course.

The Langlebert-Horand bandage applies to the relief of inflammation the most potent remedies of the surgeon's armamentarium—namely, heat, moisture, rest, and pressure. The scrotum is first enveloped in cotton, over this is placed a sheet of rubber dam, finally a stout suspensory bandage is applied. The bag of this bandage is shallow, and at the sides are gores which are provided with eyelets and laces. By lacing at the sides the bandage may be made not only to press the affected organ upward against the body, but also to exert lateral pressure, so that the testicle is everywhere evenly and uniformly supported.

Horand treated 200 cases with this dressing. In one, on account of marked involvement of the cord, the bandage was painful. In two others epididymitis of the other side developed. In the others there was practically complete relief from suffering in from thirty to sixty minutes. The patients were enabled to attend to their ordinary vocations, and resolution followed in a remarkably short time. These results of Horand are abundantly confirmed by other observers.

We have made a modification of the Langlebert-Horand bandage, with which we have obtained results as gratifying as those reported by French observers. The body of the suspensory is made of mackintosh, lined with stout cloth; this supplies the place of the rubber dam and is more readily adjusted. Cotton-wool or ordinary cotton batting is better

than absorbent cotton, since the free sweating occasioned by the close application of the rubber has a tendency to cause wadding. By means of this dressing we have promptly relieved the suffering in all of the cases in which we applied it, the patients have been able to continue on their feet, and the disease has run a rapid and benign course. When the inflammation is acute, the swelling marked, the pain intense, puncture of the vaginal tunic or of the inflamed cellular tissue is indicated. These punctures should not be carried into the tunica albuginea.

It is true, Vidal reports 400 cases and Smith 1000 cases, where puncture of the albuginea resulted in no harm to the patient and greatly ameliorated his suffering. There is no proof that either of these surgeons punctured more deeply than the vaginal tunic, nor is there any reason why they should do so, since an incision carried thus far as effectually relieves pain as one carried into the substance of the gland. Castelnau, Demarquay, Salleron, and others report cases of total extrusion of the testicle after puncture of the albuginea. The practice is, however, at the present day, universally condemned, the majority of text-books merely mentioning it as a procedure to be avoided.

In puncture of the tunica vaginalis the knife can be entered to the depth of a quarter inch to a half inch, the seat of puncture being selected in accordance with the position of the testicle and the presence of fluctuation. Such punctures should always be made under full antiseptic precautions. When pus forms, free incisions are, of course, indicated.

We believe the treatment outlined above is all that will be required for the cure of even the most active forms of inflammation of the epididymis.

Conclusions.—1. Gonorrhœal epididymitis occurs most frequently in those who have received no treatment for the original urethritis. Its outbreak is frequently determined by violent or long-continued physical exertion, or by venereal excess.

2. The resultant induration of a gonorrhœal epididymitis

does not in the majority of cases cause obliteration of the convoluted duct. Statistics on this point are misleading, from the fact that it is practically only the few sterile patients who are subsequently observed by surgeons, and hence these form the greater number of the reported tabulations. Of four cases of double epididymitis observed by us, not under treatment for sterility, there was an abundant discharge of spermatozoa in three.

3. Unilateral epididymitis may, in exceptional cases, cause permanent sterility. During the acute attack very few spermatozoa are found in the semen.

4. Obliteration of the duct does not cause atrophy of the testicle.

5. Pain, tenderness, and swelling in the groin, dependent on funiculitis, practically always precede gonorrhœal epididymitis. Prompt treatment at this stage may abort the inflammation of the epididymis.

6. The development of gonorrhœal epididymitis is, in a great measure, avoided by the use of antiseptics by the mouth, and the application of a suspensory bandage to the scrotum.

7. The pain and disability usually attendant on gonorrhœal epididymitis are promptly allayed by puncture, or aspiration of the serous exudate contained in the tunica vaginalis and the cellular tissue placed behind and above the epididymis, followed by the application to the scrotum of a thick layer of cotton, over which is placed a mackintosh suspensory, so made that it presses the inflamed organ upward against the pubes, and, by means of lacings at the side, can be so drawn in that uniform lateral support is secured. Punctures are necessary only in the most acute cases.

8. The subsequent induration after the acute stage is most quickly resolved by a continuance of the dressing above described, together with the local application of belladonna and mercury ointment, and the internal administration of potassium iodide.

THE MICROSCOPICAL ANATOMY OF THE HUMAN HEART.

Showing the Existence of Capillaries within the Muscular Fibres.

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PHYSICIAN TO THE PENNSYLVANIA AND CHILDREN'S HOSPITALS.

[Read April 1, 1891.]

In the pursuit of pathological studies directed especially to the investigation of Bright's disease, vascular changes, and heart disease, and to the relations of these morbid processes one to another, I have examined a large number of human hearts. At the present time there are in my collection sections of forty-nine hearts, which are in most instances accompanied by full clinical histories of the patients. The causes of death included violence and many different diseases, and the ages ranged from an early embryological condition to three weeks after birth, and upward to old age. My studies have been carried on now during a number of years, and it has impressed me, as of course it must everyone who attempts to investigate pathological changes, that the most important and difficult problem is to decide what particular appearances in a given tissue are histological and what pathological. One result of my labors has been to lead me to the observation of certain appearances of the normal microscopical structure of the heart which are, so far as I know, new, and which certainly are not commonly known either to histologists or pathologists. These appearances are connected with the condition both of the vascular supply and of the structure of the muscular fibres, and it will be impossible to describe the one without alluding to the other also. The arrangement of the bloodvessels will be dealt with first.

Upon the surface of the heart there are numerous arteries and veins of the ordinary structure, having three coats, the middle or muscular one having circular fibres. Though veins having three coats are always present on the surface of the heart, my studies have led me to the conclusion that they are rare in the muscular walls, where the three coats are found only in veins of large size, and the smaller ones have but a single coat. This single layer is composed of endothelium, and is in appearance and thickness precisely like the wall of the smallest capillary. On the other hand, the arteries can be seen to have three coats, the circular muscular fibres being distinctly visible, until the size of the vessel is little greater than that of the capillaries of least diameter. This process of transition from arteriole to capillary is one of great interest, and is accurately depicted in Fig. 1.

The mode of transition from arteriole to afferent capillary is in strong contrast with that of the efferent vessels. The condition of things will be better understood by examining Fig. 2, which admirably represents the ordinary appearances of the return vessels, than by any verbal description. The vessel into which the capillaries of the smallest size empty their contents is, as may be seen, one having walls no thicker than the smallest capillaries, and of a structure precisely similar. The smaller capillaries, too, at their junction with the larger vessel often form much less acute angles than is usually the case at the points where the arterioles break up into afferent capillaries. The small efferent capillary even forms a right angle with the larger one, thus emptying its blood into a stream flowing directly at a right angle to its course up to its termination. Another striking point, and one worthy of note. is that these efferent capillaries seem much more numerous than the afferent ones, perfect showers of them emptying into the larger vessels within small areas, while at the points where the arterioles break up the number of capillaries is relatively much less. The large efferent vessels are of much greater diameter than the arterioles by which they are accompanied and with which they correspond, but whether this was the case during

life or whether the vessels carrying blood out from the tissue are larger because they remained distended after death with blood, it is, of course, impossible to decide.

The usual condition of things, then, in the substance of the heart is that when parallel vessels, the one a carrier of venous and the other of arterial blood, are examined, the arteriole is found to have the structure commonly described as proper to vessels of that nature, being composed of three coats, while the venous vessel exhibits but one coat, and this presents an appearance identical with that of capillaries of the smallest size, being endothelium alone. The appearances described are fairly well represented in Fig. 3, and the nature of the material forming the vein is further made evident by the fact that at one end it is slightly folded.

The important anatomical point to be made is that the *venæ comites* of arterioles in the walls of the heart are vessels having but a single coat.

The distribution of the capillaries in the muscular substance of the heart is well known up to a certain point; histologists thoroughly understand that the minuter arterioles have their termination in capillaries which, after ramifying among the muscular fibres, finally end in venous radicles to discharge the blood at last into the right auricle. To say, however, that the whole circuit of the vessels has been thoroughly traced out as has that of even the minutest capillaries in the liver and kidneys, would not be true, for in the ordinary works upon the subject the matter is not pursued beyond the statement that the muscular fibres are richly supplied with capillaries. The capillaries run, of course, in all directions amongst the muscular fibres, parallel with and between them, at acute angles across them, and again often at right angles. The appearances presented in the last instance are well shown in Fig. 4, which represents a small capillary crossing muscular fibres at nearly a right angle. This describes the more ordinary conditions of the minute vessels of the heart as they have presented themselves to me, and it becomes necessary now to approach the second and still more important part of the subject, the appear-

ance and structure of the muscular fibres in their more intimate relations with the smallest capillaries.

Sections in which the muscular fibres have been cut as nearly as possible directly across their length show the position and number of the smallest capillaries and their relation to the fibres in a more graphic and unmistakable manner than any others. Under these circumstances the vessels present themselves in the form of circles, or, if the section has been at all oblique, as ellipses. Those who have studied sections of bloodvessels will realize how vastly easier it is to draw conclusions in regard to their condition when transverse sections are under consideration than if they be longitudinal. The vessels being hollow cylinders, the variety of the appearances is infinitely less in the case of transverse sections, for then the pictures presented are always in the form either of a circle or an ellipse, and if it be an ellipse the difference between the longer and shorter diameters gives a knowledge of the degree of obliquity of the section. On the other hand, in the case of longitudinal sections, the variety of appearances that may be produced is almost infinite. It would be quite impossible to give any adequate description of these varying appearances, but the mere mention of their existence is sufficient to remind anyone who has given personal attention to investigation of the subject, of the truth of the statement, and of the further truth too, that under the best circumstances studies with the microscope of vessels in longitudinal section yield less satisfactory and less conclusive results than cross sections. Fig. 5 is a carefully made scale-drawing of a single field under the microscope of such a cross section, and it exhibits all the different appearances which it is desired to describe as existing in the heart when seen in that way. It is easy to recognize the vessels as they lie in the connective tissue, where they generally appear as minute circles, with walls of exceeding delicacy and of equal thickness around the entire circuit. There are a few, however, of the capillaries which exhibit upon one side much greater thickness of wall than elsewhere, reminding one of the appearance of a seal ring when looked at from the side. Such thicker spots are caused by the knife having

cut through a nucleus in the endothelium of which the walls of the capillary are formed. A closer examination of the drawing, however, brings to light the fact that these empty circles are not to be seen in the connective tissue alone, but exist also half-imbedded in the sides of the muscular fibres and even entirely within them. When I first observed these circles lying within the muscular fibres, and at their edges partially imbedded in them, I did not know what explanation to offer for their appearance. It seemed as if they must be capillaries, and yet the fact that they were closely surrounded by the darkly-stained muscular material made it at first impossible to determine that there was any endothelial wall separating the lumen from the encircling muscular fibre. Closer examination, however, brought to light the fact that in places endothelial nuclei could be distinctly seen (see Fig. 5), and study of a great number of sections from many different hearts showed that occasionally the endothelial wall could be seen in capillaries entirely imbedded in muscular fibres, thus forcing me to the belief not only that the capillaries enter the muscular fibres, but that they actually penetrate to their very centres.

In order to prove this conclusion to be correct it was necessary to find corresponding appearances in longitudinal sections. As has been stated, longitudinal sections do not yield such satisfactory results as transverse ones, and the appearances are much more difficult to interpret owing to the infinite variety of forms produced. Fig. 6 represents muscular fibres cut longitudinally, and there can be no doubt of the presence of cavities in the centres. The nuclei look as though they lie loosely in the spaces. It is curious, too, how frequently the appearance here represented may be seen, that of two nuclei lying quite close to each other in the same fibre. It cannot, of course, be expected that a section should be cut which would run precisely parallel to the centre of a fibre for a great distance, though this would be necessary to demonstrate ocularly any great length of a canal in such a fibre. At the same time some of my sections do show fibres which seem to be channelled out for a considerable portion of their length. Of course,

it might be said that all these spaces which have been depicted and described are simply the result of splitting of the tissue in course of preservation and preparation, and such an assertion would be difficult to disprove so far as the appearances in the longitudinal sections are concerned. The appearances, however, in the transverse sections do not seem to admit of such a view being reasonably entertained. The presence of the endothelial nuclei, and the fact that occasionally the whole circle of endothelium can be made out, most emphatically contradict such an assertion.

It would be interesting to know at how early a period of life the capillaries exist within the muscular fibres, for the manner in which the muscle tissue grows from nuclei, which at an early period are not to be distinguished morphologically from the nuclei from which the other tissues arise, proves that capillaries do not exist within the muscular fibres in young embryos. The explanation of the presence of the brown pigment which is always found in the muscular fibres of adult hearts is one requiring investigation. The fact that the cavities or channels which have been described are most common and most marked in the parts of the fibres near to the nuclei, and that the pigment too is found in the same position, would seem to point to this pigment being in intimate relation with or derived from the blood.

Before leaving the subject, it would seem well to call attention to the fact that if further investigation by others should confirm the correctness of the views that have been unfolded, it may be found that we will be able to improve our understanding of the pathological processes that take place in the heart; processes which constitute an immensely important element in a great portion of chronic diseases, especially those of people past middle life. The fact that return vessels of considerable size, whether we choose to call them veins or large capillaries, have walls of exactly the same thickness and structure as the smallest capillaries is another evidence of the thorough provision there is for a bountiful supply of nutrient material to the heart. Vessels of this character, it would seem, must have a double, if not treble, function—the walls are so

thin that they must partake directly in the nourishment of the tissue; they probably act as reservoirs, owing to their great distensibility; and, lastly, they certainly are carriers.

It would be easy for me to enter at length, and the temptation to do so is great, into a discussion of the bearing of the observations that have been detailed upon questions of the pathology of the heart, but I must content myself by saying that in conditions of disease the cavities in the fibres are sometimes enlarged to such an extent that such fibres, when seen in cross-section, present themselves as hollow cylinders with thin walls.

A brief recapitulation of the points it has been especially desired to emphasize may form the best conclusion of my remarks upon this anatomical question—a question which, viewed by itself, is of great interest, but when considered in its relation to pathology seems to me to open a field for labor and increased knowledge which may be of almost boundless extent. The points, then, are as follows:

1. That the return vessels in the substance of the heart, except a few of the largest size, have thin walls and a structure identical with that of the most minute capillaries. In this respect they present a strong contrast with the arterioles, as the latter, even when of very small size, are similar in structure with large arteries, both having three coats.

2. At points where these return vessels are formed by the coming together of minute capillaries, the number going to form the return vessel is very much greater than at corresponding positions where arterioles (supply vessels) break up, and the angles formed are much less acute, right angles even being formed at such junctions of the venous vessels.

3. The observation of the presence of spaces in the fibres of normal human heart muscle is likely to prove of great importance, if the explanation that they are capillaries is correct. The fact that endothelial nuclei can be seen at the edges of such spaces in almost all properly-prepared sections, and that occasionally even the whole circle of the endothelial wall is visible, would seem almost conclusive evidence of the correctness of this explanation.

Explanation of Plates.[1]

Fig. 1. Represents the transition of a minute arteriole into capillaries. It is seen that circular muscular fibres are scattered along the vessels even after they are of the smallest size, at last disappearing, and the capillary then being composed of endothelium alone. The angles formed at the points of division are acute.

Fig. 2. Is a picture of the coming together of many capillaries of the smallest size to form one of the comparatively large efferent vessels which perform functions directly the opposite of those of such arterioles as that represented in Fig. 1. It is noticeable that the number of capillaries is very great, and that the angles formed are much less acute than at the subdivison of the arteriole, in some instances being almost right angles. The vesel, too, is of fully twice the diameter of the arteriole.

Fig. 3. Shows a portion of an arteriole and its accompanying return vessel lying beside each other. The vein has a bit of muscular fibre lying over a portion of it, and at one end is folded. The fold shows how thin is the substance forming the wall. The accompanying arteriole is of only about half the diameter of the vein, and the circular muscular fibres cut across are very distinctly visible upon one side. The contrast in structure of the two vessels could not be made more plain than it is by this picture. The difference in size, too, of the two vessels is a most striking feature.

Fig. 4. Is a drawing of a capillary running nearly at right angles to the muscular fibres it is crossing.

Fig. 5. In this picture are seen primitive muscular fibres, with the intervening connective tissue and many capillaries cut across. It should be noted that the muscular fibres in cross sections do not generally appear as circles, as is commonly represented, but are very irregular in outline, though some are nearly circular. This must be due to the branching, or, as it is commonly called, anastomosing, of the fibres. The important feature, however, is the situation and appearance of the capillaries. It is easy to see that they lie in the connective tissue, are partially imbedded in the sides of the muscular fibres, or are even in their centres. The fact that they are capillaries is shown by the presence of the endothelial nuclei cut across in some of them, giving them the appearance of a seal-ring seen from one side. This resemblance to a seal-ring is very plain in a number of capillaries in the picture, and in a number of instances capillaries can be seen in the very centres of muscular fibres. The most marked instance is that of the large capillary near the centre of the picture to which there is a pointer. The pointers draw attention to capillaries which exhibit the described characteristics in marked degree.

Fig. 6. Represents two muscular fibres in longitudinal section which have large, elongated cavities in their centres. It is noticeable that in both instances there are two nuclei quite close together, and that they seem to lie in the spaces without attachment to anything.

[1] The plates are from drawings made by Dr. Allen J. Smith.

Fig. 1.

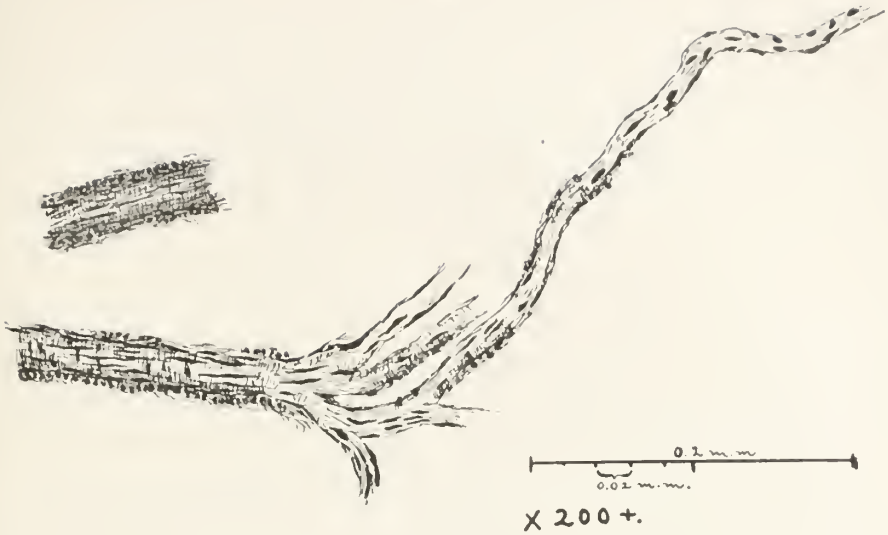


Fig. 2.

Fig. 3.

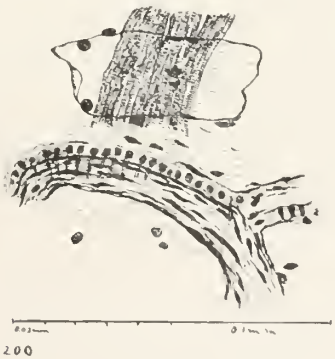
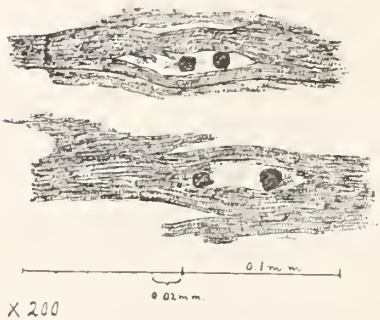


Fig. 4.

Fig. 5.

Fig. 6.



DISCUSSION.

Professor John A. Ryder: It has seemed to me, viewing the matter from the standpoint of physiological anatomy, that the observation of Dr. Meigs is of extreme interest. I can understand why these capillaries are not seen in cross section of the muscular fibres of the heart in the early stages. Many of the structures that we see in the adult organ are really developed during what embryologists speak of as the post-embryonic period. When we reflect upon the way in which muscle universally develops, no matter whether it be in the salamander, the fish, reptile, bird, or mammal, we can see how, in the later stages of the development of the heart, such a thing as enveloping or inclusion of capillaries might occur. It is well known to everyone who has made a cross section of a developing muscle, that the fibrillæ appear as delicate threads imbedded in the protoplasm forming the body of the muscle-cell. That is the type found in the highest form of muscular development. There are forms of muscular development in which the fibrillæ are developed in a continuous roll, and, as a result, the muscular fibre resembles a flat plate made up of parallel filaments. However, as we pass up in the animal scale, and particularly in mammals and birds, the muscular fibres become irregular in shape and excessively numerous and closely packed together, with very little protoplasm between. When we remember that the multiplication of these fibrillæ seems to result from splitting up or multiplication of the fibres already present, we can understand that, as the muscular fibres grow in thickness, any capillaries that might lie beside them might readily be engulfed and covered in by the multiplying fibres.

It seems to me that the points raised are exceedingly interesting from an anatomical standpoint, and from the standpoint of physiological anatomy. This occurrence of capillaries in the muscle fibres is remarkable. We know of very few instances of the canalization of cells. There are some cases in which the cell is actually penetrated by a canal. Such instances are found in the flat worms in which the water-vascular system which answers to the kidney in the higher animal is made up of a set of cells placed end to end, which are channelled out, forming a system of vessels. Penetration of the muscular fibres in this way by capillaries is analogous, although, of course, not identical. The subject is one which admits of a good deal of expansion, and, I think, is well worthy of some extensive investigation, particularly as to the mode of development.

So rare is it for anatomists to discover anything new in the human body, a subject which has been threshed over by so many capable hands, that it is really creditable to Dr. Meigs to have worked out so carefully these results. I believe that in the course of time these capillaries will be referred to as

"Meigs's capillaries," named after him as many such discoveries have been named after the one who first called attention to them.

Dr. Henry Hartshorne: I rise simply to express the wish that Dr. Meigs had said something in regard to the application of these facts to pathology. If he has a hint or two on that subject it would be of interest.

Dr. Francis X. Dercum: If any doubt could exist in regard to the structure of these capillaries, it might be possible to make injection preparations. This would settle any cavil in regard to their existence. Certainly the discovery is a marvellous one from the fact that it is a distinct addition to our knowledge of the old subject of anatomy. It certainly makes clear how abundantly the heart is nourished, and how magnificent are the provisions for the maintenance of a structure which has so little rest. It also explains how, in conditions of weak heart, return of strength and recovery may occur under proper treatment.

Dr. Thomas J. Mays: I have listened with a great deal of pleasure to this paper by Dr. Meigs. It has occurred to me that there may be an analogy between what Dr. Meigs has discovered and the lacunæ in the frog's heart, described by Pintz in 1883. It is well known that the frog's heart continues pulsating for a long time after removal from the body, and the query has been, Where does the heart obtain the nutritive element or force with which it performs this work? Pintz, on investigation, found spaces in which nutriment was deposited. König and he named these lacunæ—that is, spaces in the muscle which contain nutriment. Whether these are located in the fibres or between the fibres I do not know.

It is remarkable that these spaces should also exist in the human heart, and in close communication with the circulation. It is also remarkable that both Dr. Meigs and Pintz should come to the same conclusion as regards the physiology of these spaces, that they serve as reservoirs for the storage of nutriment.

Dr. Meigs: It is, of course, desirable that injections of the heart should be made to further prove the conclusions I have announced. Such preparations I have not made, partly from lack of time and partly because it has seemed to me that the reasons already given are almost final. My conclusion that the spaces are capillaries is fortified by certain appearances sometimes seen in diseased hearts. In persons dying of disease the histological appearances found are very variable. It is not at all uncommon for the muscular fibres, when seen in cross section, to appear as mere hollow tubes with thin walls. This condition, which I have often found in pathological hearts, led me to the belief in the first place, and fortified me in the conclusion finally, that the spaces in the muscular fibres in healthy hearts are actually capillaries, and not the result of bad technique or alteration of the tissue in course of preparation.

EXHIBITION OF SPECIMEN FROM A CASE OF CÆSAREAN SECTION WITH REMOVAL OF THE UTERUS AND LARGE FIBROID TUMOR.

By JOSEPH PRICE, M.D.

[Read April 1, 1891.]

I HAVE here a unique specimen removed yesterday.

The patient was a woman thirty-nine years of age, a mulatto, married ten years. She probably became pregnant between June 3d and June 10th. I waited as long as possible before operating, and it is my impression that she was in labor when I operated. The operation was a simple one, except for the adhesions. It consisted of an incision in the abdomen, placing small, flat sponges between the uterus and the abdominal wall, with an assistant pressing the abdominal walls against the uterus. An incision was then made in the uterus, and the fœtus delivered. The uterus and sponges were then squeezed out of the incision, the adhesions separated, the tumors delivered, a Kœberlé nœud applied, and the tumor cut away. A number of adhesions were tied, and the bowel required stitching. Irrigation and drainage were practised. The operation was done at 10.30 yesterday morning, and at 5 o'clock this afternoon the patient was doing well.

These specimens demonstrate some of the changes following the use, and I should say the grave abuse, of electricity. If the use of electricity is to be continued in fibroids, it will hold the hands of the surgeons, as they will refuse to operate in such cases on account of the complications induced by the use of electricity.

The placenta in this specimen is in position, and the cord is over four feet long. The tumor on the right had strong intestinal adhesions. It was enveloped by bowel and omentum. This woman had been under electrical treatment for a long time. The electrician, probably mistaking the absence of the period or the delayed period for the beneficial result of treatment, continued it without recognizing the pregnancy until the fourth month. At that time there was a violent peritonitis following the application of elec-

tricity. The physician who treated her for the peritonitis told me that she had a very narrow escape. After recovery he sent her to me. Here in one tumor we have an abscess, which is a change which often follows the use of electricity. In many of these tumors you will find a cystiform degeneration following the use of electricity.

Ten days ago I removed a large tumor from a woman aged fifty-three, who had done very well until electricity was employed. She then had paroxysms of severe pain and localized attacks of peritonitis, and, finally, demanded removal of the tumor. From the beginning it was a knife operation, and one of the most trying that I have ever attempted.

The Fellows will remember that, in a late discussion on ectopic pregnancy, Dr. Goodell, in speaking, referred to a patient whom he had seen in consultation a few nights before—a case which had led him to change his views in regard to the use of electricity. Yesterday I removed one gallon of pus from that woman's abdomen. Unless one has given this subject consideration, he can have no idea of the amount of mischief which may follow the use of electricity. Language fails to express my unqualified condemnation, and that which everyone feels when he comes to operate on such cases.

DISCUSSION.

Dr. J. M. Baldy: In the past few days I have read several articles upon this subject, one by Dr. Keith, of Edinburgh, and another by Dr. Kellogg, of the West. I must say that the statements made by such conscientious observers in regard to the use of electricity in fibroids, and the material that they have presented, have rather staggered me. Dr. Keith claims that small fibroids can be dissipated, and he quotes his cases, giving detailed accounts of them. Dr. Kellogg reports a series of cases in which he dissipated the tumors entirely in some seventeen, reduced the tumors and cured the symptoms in forty-two, cured the symptoms in some fourteen more, and only failed in eleven or twelve cases, and half of these he cured by surgical measures. In the face of such evidence as this, it is not fair to make such sweeping statements as have been made this evening. The reports to which I have referred have been made by men of world-wide reputation, and all the details are given, and the results are unquestioned. I have myself seen the symptoms relieved markedly and promptly, but I have never seen the tumor dissipated, and I have a good deal of doubt in regard to the decrease in size in the cases which I have seen myself.

Now as to fibroids obstructing labor, the question is a serious one, especially when we come to consider Cæsarean section. As a rule, fibroids do not obstruct labor. I know of cases in this city where the diagnosis was made by such men as Dr. Kelly and Dr. Goodell, and in both cases Cæsarean section was con-

sidered essential, but in both instances the women fell into labor, and were delivered without the assistance of a physician. The mere fact of a fibroid tumor in the pelvis, or the uterus being involved by fibroid degeneration, is not a positive indication for Cæsarean section. To throw out the general idea that all cases of fibroid blocking the pelvis are cases for abdominal section is not exactly the proper thing.

Dr. J. Cheston Morris: If Dr. Price includes in his condemnation all forms of electricity, I must enter my protest against such a doctrine. For twenty-five years I have used electricity in the treatment of fibroids. I have treated a large number of cases with tumors of all sizes. I have seen, under the application of electricity, these fibroids diminish gradually, and, when they were not too large, disappear. If I can modify the growth, and make the patient comfortable, and allow her to lead a useful life, unencumbered by the tumor except by its weight, I think I have accomplished much. Among the patients under my care was a colored woman who had three large fibroids buried in the structure of the uterus. She also had Bright's disease in an advanced stage. I placed in the uterus an intra-uterine stem-pessary of zinc and copper, and I succeeded in keeping her alive for four or five months. I found at the autopsy that the intra-uterine stem pessary had laid across one of the fibroids, and immediately under that there was a cystiform degeneration in the fibroid. I have known these fibroids to soften down and discharge an offensive grumous fluid, and the uterus afterward contract and the patient become perfectly well.

In the treatment of these cases I use either faradization or the primary current from the stem-pessary (of the galvanic action of which I have no doubt, on account of the corrosion that occurs in the zinc). Where I wish to bring up the tone of the uterus and substitute a healthy condition for an unhealthy one, I use the faradic current. Where there is no unaltered muscular structure I then remove congestion and chronic inflammation by the primary current, which is far more useful. In all these years I have yet to see a case of inflammation following such a course of treatment. Unless we had the full history of such cases as Dr. Price has reported I do not think that it is fair to ascribe the bad results to the application of electricity, for the patient may subsequently have received some blow or injury which set up the inflammation. I do not believe that electricity, applied by skilled hands, would be likely to set up such a result in an appreciable number of cases.

In regard to the intra-uterine pessaries, there are two points on which I insist. In the first place the proper size is important. It should be from one-eighth to three-sixteenths of an inch shorter than the internal length of the uterus. If less than that, the uterus will double over; if longer, it is likely to press against the wall of the uterus. In the second place, I insist that the patient shall remain in bed until all signs of irri-

tation have disappeared. The introduction of the pessary is followed by a cramp-like pain, and there will be a hemorrhage from the uterus. If the patient moves about much before the hemorrhage has disappeared, there is liability to inflammation. Otherwise there has been no trouble from this measure.

Dr. Price: I would ask Dr. Morris whether he has had the same happy results in fibroids in other parts of the body?

Dr. Morris: I have not treated many other fibroids, as they are not in my line.

Dr. Price: It is a curious thing in regard to electricity, that those who use it claim that it accomplishes much in these obscure regions, where, in many cases, it is difficult or impossible to make an accurate diagnosis, and where many conditions can be confounded with fibroid tumors. They say that they reduce the size, relieve the symptoms, and save the patient an operation. I remove one in about every twenty that they see. I imagine that I remove one in about every thirty that I see myself. Just here I want to apologize for not operating on the other twenty-nine. Electricians admit that, unless they take every precaution, there will be a certain amount of inflammatory trouble. They admit that they have some suppuration and retrograde changes; and some go further, and admit that they have had deaths. Dr. Keith regrets that he has not his thirty-eight cases of hysterectomy, with three deaths, back again, and accuses the London men of removing small, healthy tumors with good results. I wonder why Keith does not pause and wonder why he did not remove the thirty-eight tumors while small and healthy, instead of waiting until they had become complicated, requiring horrible operations. If he had done so, he would not have had his three deaths. A few years ago I attended a meeting of the New York Obstetrical Society, and an electrician from Brooklyn presented a tumor that had sloughed and come away, and the woman barely escaped. The only remark that Dr. Emmet made in regard to this case was that "the good Lord had seen fit to save her." It was not the electricity that saved her or caused the expulsion of the tumor.

Dr. Baldy places himself in a new light. We now scarcely know where to place him. He has put himself on record probably over one hundred times on the opposite side from that which he takes this evening. Dr. Keith, in a recent letter to his son, states that he has lately done a hysterectomy. I think that he has had one case of death from hemorrhage a few weeks after the application of electricity. I have seen these tumors grow rapidly, notwithstanding the fact that the woman had the ordinary phenomena of the menopause. The application of electricity may increase the size and increase the hemorrhage. I send many of these patients to their homes without operation. I see them in large numbers without thinking of hysterectomy or removal of the appendages. There may be a tumor the size of a fœtal head filling the pelvic basin, which receives two or three

applications of electricity, and is followed by one or two attacks of local peritonitis, and when we come to operate we find the tumor fixed and adherent to the pelvic viscera, and to the small and large intestines, and perhaps both ureters dragged up with the tumor. I have seen the ureters carried six to ten inches from their normal position. The word of caution which I wish to speak in this connection is, that if you can do no good, I beg of you to do no mischief. In justice to Dr. Morris, I wish to say that I receive very few cases that have been treated by the general practitioner.

A CASE OF PORRO'S OPERATION, NECESSITATED BY FIBROID TUMOR.

By JOSEPH PRICE, M.D.

[Reported May 6, 1891.]

In the absence of the reader of the paper I might allude to a Porro operation which I did on Sunday a week ago. The drawing, which I brought to use on Dr. Noble's paper on Cæsarean section, shows the placenta partially delivered. The patient was twenty-eight years of age, a domestic, married two years. It would seem that marrying late in life favors this condition, particularly in the large domestic element we have about us. I have found a large number of pelvic tumors in this class of patients—four in the last eight months. This woman had been seen by a physician who had failed to recognize the character of the pelvic tumor. She had been in labor perhaps a week. I saw her at 4 P.M. on Sunday, and found the uterus in a tetanic contraction, with child dead and a fibroid completely blocking the birth passage. I at once had her removed to better quarters, and did the section at 8 o'clock, and delivered a large male child, probably dead two or three days. I also delivered the uterus and applied a Koeberle clamp. The tumor was much darkened from contusion. The pulse has remained below 100 and the patient is doing well.

I might in connection with this case allude to one on which I operated the following day. The patient was referred to me by an excellent man, who stated that he at one time thought she was pregnant. I examined and wrote him that I found a tumor, but was satisfied that she was not pregnant—that it was a multinodular fibroid. I requested that she be given a laxative and return. At the next examination I looked over her history carefully, and found that she was twenty-eight years of age; that the menstrual history was regular until ten months ago, when she had menstruated for the last time. Her abdomen increased rapidly in size, and when I saw her corresponded to that of the gravid uterus at term. I could find no fœtal heart-sound. She had all the rational symptoms of pregnancy, and at the second examination, when I placed my hand on the abdomen, I received a distinct kick. She stated that she had observed these movements for some five

months. I had two or three physicians examine her, and some thought that she was pregnant. I did a section and removed a tumor, but there was no semblance of a fœtus, but a number of fibroids and a huge abscess in one of the tumors. She is doing well. This is an interesting case. Most authorities refer to profuse and irregular bleeding as a symptom of fibroid tumor. Occasionally I find this, but this statement does not correspond with my experience. I could cite a large number of cases where the menstrual history has not corresponded with what is usually stated in the books or taught.

I have had three Porro operations; all successful; two living children.

I once did a Cæsarean section, but have always regretted it. I lost the woman from pneumonia. If I had done the Porro operation I am satisfied that the woman would have recovered. I have seen a number of Cæsarean sections in this city, and I am satisfied that all the patients made very narrow escapes and still suffer sequelæ of the operation. The local peritonitis that has followed has saved about all of them. I now have a woman who comes to the clinic every few days and brings with her a stitch. She has three or four sinuses and all the stitches are coming away. The parietal adhesions in this case have saved the patient from a general peritonitis that would have proved fatal. The Cæsarean section is also objectionable in that it subjects the woman to the risk of a second operation.

DISCUSSION.

Dr. John C. Da Costa: I would ask Dr. Price why he did the operation: whether it was because the pelvis was contracted so that the woman could not deliver the child, or whether it was blocked by fibroid tumors, or whether he operated for fibroid tumors themselves? What was the reason for the operation? He has told us of the operation, but not given the reason for doing it.

Dr. Price: The birth passage was completely blocked by an impacted fibroid, which was about five inches in one diameter and six inches in the other. There was no possibility of delivery.

There is another consideration in these cases. Some of these women have been in labor for days or even weeks, and when Cæsarean section is done you leave an unhealthy uterus and will lose your patient. I might also say here that hysterectomy has been recommended in puerperal fever and in puerperal metritis, and one or more lives have been saved by the operation.

UNIQUE CASE OF CÆSAREAN SECTION.

By CHARLES P. NOBLE, M.D.,
SURGEON-IN-CHARGE OF THE KENSINGTON HOSPITAL FOR WOMEN, PHILADELPHIA.

[Read May 6, 1891.]

On April 27, 1890, I was called to see Mrs. J., the messenger stating that she was in labor, the waters having come away. I found her a vigorous little woman, twenty-seven years of age, and fifty-five inches in height. She was in the ninth lunar month of her sixth pregnancy. The first four pregnancies ended in miscarriages. The fifth pregnancy was terminated by Cæsarean section, done by Dr. Howard A. Kelly, April 17, 1888. A full account of this operation can be found in the *American Journal of Obstetrics* for March, 1890; but, as it has a distinct bearing on the case, a brief account of it will be given.

During the labor of her fifth pregnancy Mrs. J. was successively in the hands of a midwife, a physician, and two physicians in consultation. The grave nature of the case was not recognized, and the attendants waited for two weeks for the cervix to dilate. At the end of two weeks Dr. Kelly saw her in consultation. The pelvis was found choked with inflammatory exudate, which made an absolute barrier to delivery *per vias naturales*. Cæsarean section was done, as affording the only hope to the patient for life. At the time she was profoundly prostrated, with a pulse of 142. A feeble, jaundiced infant was delivered, which lived a week. As a result of the conditions present at the time of the operation, the uterine wound became infected; circumscribed peritonitis, with adhesion of the womb to the abdominal wall, resulted, and later a breaking down in the line of union in the abdominal wall and uterus occurred, and thus a utero-abdominal fistula was formed through which the uterine contents discharged externally. The cervix broke down, and half of it came away in a slough. The patient had a narrow escape, but recovered. The fistula never healed soundly; at times it would heal, only to break down at a menstrual period to allow of the escape of some of the menstrual blood. The patient's general condition became good, and the pregnancy resulted which is the subject of this communication.

On examination I found that the membranes had ruptured, and that the

waters were coming away through the ventral fistula, which was dilating under the influence of the feeble pains which were present. The cervix was scarcely at all dilated, and the os could be felt surrounded by cicatricial tissue left from inflammatory processes attending the preceding labor. It seemed plain to me, from the condition of the soft parts alone, that were spontaneous labor possible, the child would be delivered through the ventral fistula and not through the vagina. The scar from the former Cæsarean section was found quite stretched out by the intra-abdominal pressure. The recti muscles were separated about one inch. The fistula was situated about midway between the pubes and umbilicus. Projecting through the fistula a process of amnion was plainly seen. The child lay in the third position. The head was quite movable above the superior strait. The fœtal heart-tones were easily heard, showing that the fœtus was alive, though it evidently was quite small and immature. The soft parts of the pelvic outlet were those of a nullipara. The cervix formed the centre of a mass of scar-tissue. The lateral pelvic walls were easily palpated; but, owing to the scar-tissue back of the cervix, it was difficult to reach the sacrum.

The pelvic measurements were as follows: A.S.S., twenty centimetres; Cr. I., twenty-five centimetres; D. B., fifteen centimetres. The conjugate diameter could not be taken, owing to the fixation of the cervix.

Knowing the condition of the pelvis and the former history of the patient, I concluded that the treatment which offered most to both mother and child was prompt Cæsarean section. The patient and her husband, impressed by the nature of the preceding labor, gladly accepted my advice. Preparations were made at once to remove the patient to the Kensington Hospital for Women. Dr. Robert P. Harris saw Mrs. J. with me in consultation, and agreed with me in urging prompt operation, which was done under strict asepsis.

The technical details of the operation were unique. My index-finger was inserted through the fistula into the uterus, and upon this as a guide I incised the uterus and abdominal wall above and below the fistula with the knife and scissors as far as the region of utero-abdominal adhesion. Sufficient room not being afforded, the peritoneal cavity was opened and the uterine incision prolonged upward; a leg of the fœtus was now seized and the fœtus turned and delivered. It was feeble and immature (thirty-third week), and lived only a few hours.

The placenta and membranes were found strongly adherent, and it required some time to remove them. In the meanwhile hemorrhage was quite free and could not be controlled in the usual way, by the assistant grasping and compressing the cervical region, because of the intra-abdominal fixation. I quickly inverted the uterus through the operation-wound, which enabled the assistant to grasp the lower uterine segment and control the bleeding, while I peeled off the secundines. The finger was now passed through the cervix to provide a vent for the lochia. The walls of the fistula

were exsected, and the uterine incision closed by fifteen deep and seven superficial stitches. Some of the deep stitches passed through both uterine and abdominal walls, through the region of uterine adhesion. This fact accounts for the small number of superficial stitches used. The uterine wound was closed in twenty-nine minutes. The peritoneal cavity was now cleansed and the remaining sutures introduced. The patient was put to bed without shock. The convalescence was rapid and uninterrupted. Primary union of the operation-wound was obtained; and, although a number of the buried uterine sutures have been discharged, the fistula has not reformed.

Several features of this case make it of more than ordinary interest. I believe that the operation is unique, both in its indication and in its technique. I have failed to find any reference to a second Cæsarean section done upon the same woman in whom a utero-abdominal fistula had resulted from the first Cæsarean section. The necessity for terminating the pregnancy at the thirty-third week because of the escape of the liquor amnii through a utero-abdominal fistula, and the fact that, had it been possible for nature to expel the fœtus, its exit would have been through the fistula, are likewise matters peculiar to this case.

The case is of further interest from the fact that Mrs. J. is the second woman in Philadelphia to recover from the Cæsarean operation; curiously enough, the subject of the first Cæsarean section in this city also had two operations and likewise recovered from both, the operations being done in 1835 and 1837.

Practically, the most striking feature in the case is the difference in the convalescence after the two operations—the first done late, under desperate circumstances; the second, done early, when the woman was in good condition. It is but another illustration of the folly and hazard of delay, and but another argument for early diagnosis and prompt operation.

DISCUSSION.

Dr. J. Price: I can scarcely see how this can be classified as a true Cæsarean section. The author states that the woman, if she had been left to nature, would have delivered the child through a large fistulous opening. We had here a metro-abdominal fistula. The operation consisted simply in

enlarging the opening and delivering the fœtus—not a true Cæsarean section with opening of the peritoneal cavity, then the uterus. We might as well speak of delivery of the child through the abdomen after rupture of the uterus as a Cæsarean section. In those cases of rupture we open the peritoneum, deliver the child, and stitch the uterus. This case also demonstrates my position in regard to the risk of Cæsarean section; that is, that it subjects the patient to the danger of a second operation. This woman is now left in danger of a third operation. In all probability a fistula will still exist, and this poor woman must again submit to the third dangerous operation if she conceives. Surely such is not wise surgery.

Dr. A. V. Meigs: I should like to ask if Cæsarean section is not opening the abdominal wall and uterus, and then removing the child through the opening? If this be a proper definition of the operation, how can the procedure we have heard described be given any other name than that of Cæsarean section?

Dr. Price: Dr. Meigs will remember that there was an opening into the uterus before the operation, sufficiently large for the introduction of the finger. Atresia with a fistulous opening and rupture through the vaginal vault into the peritoneum could as justly be called a Cæsarean operation if followed by section. Again, enlarging fistulous openings into organs to remove calculi or foreign bodies are not true operations under their proper names. Again, in this case an attempt was made to remove the child without opening the peritoneal cavity by enlarging the fistula in a premature labor. Cæsarean section is usually done at term.

The President: A small fistula communicating with the uterus would not remove this case from the classification of Cæsarean section. The Cæsarean operation, as I understand it, consists in dividing the walls of the abdomen in the median line, opening the uterus, and delivering the child. This was practically what was done in this case, except that there was a fistula conducting into the uterus. This would not materially alter the case. It would still come under the head of Cæsarean section in the ordinary acceptation of that term.

THE TREATMENT OF TORTICOLLIS, WITH A DESCRIPTION OF AN APPARATUS FOR ITS CORRECTION.

By G. G. DAVIS, M.D.,
ASSISTANT SURGEON TO THE ORTHOPÆDIC HOSPITAL.

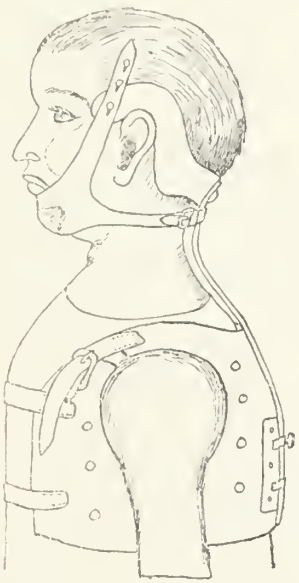
[Read November 4, 1891.]

THE patient, a boy about seven years of age, is brought before the college simply to show the manner in which he has been treated.

Eleven months ago he was ill with scarlet fever, and the glands of the right side of his neck became much swollen and painful. The physician in attendance declined to lance the swelling, and it gradually disappeared. The head was held inclined to the side on which the inflammation was located—the right—and even after its subsidence the head was still held in its displaced position. The face was turned upward toward the opposite side, and the right posterior side of the head drawn well down toward the right shoulder. This was his condition at the time of the operation. The right sterno-mastoid muscle was the one principally involved, although the trapezius also appeared to be somewhat affected. Under an anæsthetic it was impossible to restore the head to its normal position; the contraction was organic. Both heads of the sterno-cleido-mastoid muscle were freely divided by the open method, and the head brought into a slightly over-corrected position. Even after a thorough division of the tendons of this muscle, the head did not turn quite so far toward the opposite side as I wished. The wounds were closed with catgut sutures, and a few fibres of catgut laid in for drainage. The head, neck, and upper portion of the thorax were then covered with muslin bandages, over which bandages of plaster-of-Paris were applied. The head was tilted toward the opposite side, and several thicknesses of gauze, soaked in plaster, laid on the affected side of the neck to stiffen the bandage at this point. The ether was discontinued, and the child kept quiet for a short time, when the plaster was found to have set. He was then removed from the table, and placed in bed. He had no unpleasant symptom, and little or no reaction followed the operation. The next day he was seated up in bed

playing with his toys and suffering no discomfort. The plaster dressing was allowed to remain on for a few days, and was then removed and the wound inspected. This was found in good condition, and the remaining strands of catgut removed. Later, the apparatus here shown was applied, and the boy allowed to walk about. It was also kept on during the night.

Had it been found possible to correct the deformity while the patient was relaxed by the anæsthetic, treatment by apparatus without operation might have been tried, but as the contraction was organic, it was necessary to divide the muscle. An open



incision was chosen, because it enabled me to operate with greater thoroughness and safety, with less likelihood of subsequent trouble. I know of one case in which death followed subcutaneous operation, from a cellulitis, I believe, and death has likewise been known to follow injury to the large veins. Hence it did not seem advisable to incur any additional risk in order to avoid the small amount of scarring that would result from an open incision. I was, above all, desirous of thoroughly dividing all restricting bands, and also of avoiding any retention of wound discharges, should there be any, because of the employment of the

plaster dressing. The cellular tissue of this neighborhood is so loose that any tension in the wound would readily create a cellulitis, which would diffuse itself very rapidly. A vertical incision over each of the two heads of the sterno-mastoid muscle enabled me to readily isolate the contracted tendons, and divide them on a director. One might think it would be difficult to fix the head satisfactorily with a plaster bandage, but I did not find it so. The bandage set quickly, and held the head nicely. I believe in placing the head in at least a fully corrected, and, if possible, somewhat over-corrected, position. The apparatus applied after the removal of the plaster consisted of a head-piece, supported by a flat steel upright fastened to a leather body-piece. A piece of sole-leather large enough to go nearly around the body was soaked in water until perfectly soft, and then fitted to the body. It lay neatly over the shoulders above, nearly met together in front, and had openings for the arms. This was bound on with muslin bandages, and the child kept in bed. The next day the leather had hardened, and was removed and sent to the instrument-maker. He bound it with chamois leather, attached straps and buckles, and made the remaining part of the apparatus. The head-rest, or part which supported the head, is one which I originally devised for supporting the head in cases of spinal caries. Although I have never seen anything exactly like it, it possesses features common to some others. Dr. Benjamin Lee made one somewhat resembling it, as do also the appliances of Mr. Kolbe and Dr. Blanchard, of Chicago. It is made on the principle of the sling used by Dr. Sayre in his jury-mast. I believe that Dr. Sayre's sling is the most comfortable way of supporting the head known, and I wished to preserve the efficiency of that appliance while making it somewhat more firm and steady and, at the same time, neat, and not preventing the use of the hat. To do this, I substituted for the posterior part of the sling a padded steel band, which encircled the occiput and supported it, and wound around the sides of the head to above the ears. A pattern of this was first made in pasteboard to fit the head of the patient, and then made in sheet steel. This was connected to the steel upright, which was fastened to the leather jacket by an adjustable screw. The chin-sling of Dr. Sayre was retained, the two upper ends being fastened to buttons on the head-

piece above the ears, and the two lower ends buckled around the back of the neck. This apparatus is intended both for cervical caries and torticollis, and I think it will be found satisfactory in these cases. If desired, the cross-piece supporting the back of the head can be fastened loosely to the upright so as to permit motion, but I have usually had it riveted on. The transverse portion of the head-rest supports the occiput behind, and, winding around the side of the head to above the ears, prevents any lateral motion. When the chin-sling is added, the head will be found to be comfortably and firmly supported. The strap going around the back of the neck may sometimes be dispensed with. If, as in some cases of torticollis, it is desired to maintain the head in any unusual position, it can be so placed by twisting the vertical rod with a wrench. The head-piece can be raised or lowered by removing the screw fastening the upright rod to the leather jacket. The apparatus is comfortable; a child can readily sleep in it; it is not conspicuous, and a hat can readily be worn. It is made by D. W. Kolbe & Son, of this city.

DISCUSSION.

Dr. De Forest Willard: The apparatus exhibited by Dr. Davis possesses merits which are not found in some of the methods of steadying the head in torticollis and caries of the vertebræ, namely, that it has a good grasp upon the head, thereby preventing rotation and also lateral motion. This is not accomplished by the ordinary jury-mast or chin cup. For a dressing after operation for torticollis, however, a simple apparatus answers as well as any other. I employ simply an axillary ring (similar to that used in the Fox dressing for fracture of the clavicle), with a bandage to the head, and the head secured to the ring. Sometimes I use a head-gear with buckles, which is connected by an elastic strap to a leather band encircling the body. These are easily made and not expensive.

In regard to the question of open operation in these cases, I may say that while the open operation is more thorough, yet in girls, as it leaves a large wound, which is not at all pleasant to a young lady, if we can sever the muscle safely and thoroughly subcutaneously, it is well to adhere to that plan. I know that there is sometimes danger in the subcutaneous operation, yet I do not feel that it is very great if one is careful and uses force to rupture the deeper fibres of the tendon and fascia.

Dr. John Ashhurst, Jr.: I had occasion last summer to resort to the plan

of open section in a case in which I had previously employed the subcutaneous method, but in which the result was not satisfactory. I think that some fibres of the clavicular attachment of the muscle had escaped division. At the second operation I divided the body of the muscle and not the tendon. The result was successful. In regard to after treatment, while I appreciate the ingenuity of the apparatus shown, yet I confess that my feeling is with Dr. Willard, that simpler appliances are sufficient. The plan that I have pursued is to have a simple cap made for the head—of webbing or muslin—and a broad band around the chest, uniting these with an India-rubber band, which reinforces the action of the sterno-mastoid muscle on the side not operated upon. The deformity in these cases is due to lack of proper tone in the uncontracted muscle almost as much as to shortening of that which is divided. It is said by some writers to be sufficient, in order to prevent recontraction, to have the patient practise holding the head straight before a looking-glass after the operation. This might be successful with an adult, but could hardly be satisfactory with a child, and with children, therefore, the use of artificial means is of importance. In the apparatus which I have mentioned the rubber-band is attached to the head-piece opposite the mastoid process of the side opposite to that of operation, while its lower extremity is attached to the band around the body a little beyond the middle line on the side of operation. This band can then be tightened as may be necessary, in order to keep the head in a position of over-correction. The apparatus can be readily extemporized with adhesive plaster and bandages, with a rubber drainage-tube, secured with safety-pins, for the artificial muscle.

Dr. John B. Roberts: I have nothing to say in regard to this case, which I understand to have been one of spastic contraction. I have had some experience with muscular section in spasmodic torticollis from nervous affection, although not a very successful one. I have excised the spinal accessory nerve and have cut the splenius muscle, but have not succeeded in getting good results. I have had some temporarily satisfactory results from the use of large doses of gelsemium, which I believe was first recommended by Dr. Mitchell. This has been given in extraordinary doses. In one case I gave about two and a half drachms of the fluid extract of gelsemium in the twenty-four hours for a considerable period. The preparation was a good one, and the toxic symptoms were well shown.

Dr. Davis: I can see that in the cases of females it may be more desirable to avoid the small amount of scarring produced by the open incision. In orthopædics it is essential that correction should be made at once. The method of correcting deformities, particularly those due to contraction of fascia, by persistent attempts at stretching is certainly losing ground. The main reason for the open incision is that it enables one more certainly to divide all restricting bands, although, as I have said, in females the subcutaneous operation is sometimes preferable. In regard to the apparatus shown, I simply presented it as one of the means by which the desired end could be attained.

ANEURISM OF AORTA, WITH HEALED RUPTURES AND RECENT RUPTURE.

By M. HOWARD FUSSELL, M.D.

[Read November 4, 1891.]

The patient from whom these specimens were removed presented himself at the Medical Dispensary of the University of Pennsylvania July 29, 1887. He was for two years under the charge of Dr. George Dock, to whose kindness I owe the history of the case during that period.

C. L., aged forty-six years, married, stonemason. Family history good. His previous health had always been good, and he absolutely denied syphilis. He had been married twenty-one years, and had had no child. He smoked and drank in moderation, but had always taken care of himself.

At his first visit he complained of pain in the left chest and back. The pain had lasted for seven months, and he thought that it was worse in wet weather. He had a dry, hacking cough; he had lost ten pounds in weight. On examination there was noticed a prominence over the manubrium and sternal ends of the first and second left costal cartilages. Over this prominence percussion gave dulness and palpation detected a thrill. The heart dulness was normal. At the apex the heart-sounds were normal. At the aortic cartilage the first sound was normal; the second sound was replaced by a long, blowing murmur transmitted to the right and downward. The radial pulses were equal and well filled, the rate 90 per minute, the tension increased. The voice was hoarse, the cough brassy. Laryngoscopic examination showed paralysis of the left vocal band.

A mixture containing potassium iodide was prescribed.

August 22, 1887. Patient feels better, though pain still continues. Pulse 105 while standing, 75 while lying down. Over the third left costal cartilage is a long, blowing systolic murmur transmitted to the right. Diastolic murmur as before.

September 5. Patient has gained six pounds; he is still hoarse. There is no difficulty in deglutition.

29*th*. Pulsation of the tumor is visible. The dose of potassium iodide was increased to 20 grains three times a day.

March 14, 1888. Has been taking the above dose of iodide steadily. On examination there is no thrill. Dulness one and a half inches to left of sternum and down to second rib. The tumor is not so prominent. Double murmur noticed as before. Radials equal on both sides. Left vocal band is motionless, though the arytenoid cartilage moves slightly. Bands somewhat congested. He is suffering from a slight attack of bronchitis from exposure to blizzard. Has had no pain for some months.

16*th*. Slight prominence occupying the sternal ends of the first and second left ribs. There is a short, soft systolic murmur and a long blowing diastolic murmur heard over the area of dulness and to the right and upward. Pulse 60, full; tension is not increased. Slight cough, but no signs of bronchitis. Has loss of virile potency.

April 5. Dr. Dock was sent for in haste, and obtained the following history. The patient went to bed feeling well, and awoke at 3 o'clock with a salty taste in his mouth. Cough came on, and he spat up about one pint of pure blood—frothy at first and afterward clotted. On examination at 10 A.M. he was in bed; face flushed and expression quiet. Pulse 80, strong and full. Radials equal. Slight dry cough. Sputum consisted of white mucus. The thoracic examination was negative. He was kept in bed and put on low diet.

6*th*. Cough becoming troublesome; sputum sometimes bloody.

9*th*. Pulsation over dull area is more marked and over greater extent, raising the sternum, and can be seen to the right of it. There is a soft systolic and long, harsh, and loud diastolic murmur, with greatest intensity at the second right cartilage, and very loud at the third rib. It is audible at the fourth interspace and two inches to the right of the sternum. The respiratory murmurs are distinct all over the left lung, and especially at the apex.

15*th*. Pulse 60; tension good. General condition good. Complains of a dull pain over the left nipple. Respiration above the scapula posteriorly on the left side is faint. Pulsation is plainly visible from right of sternum to left axilla and from above the clavicle to second interspace. Click and thrill with systole can still be felt. Pulses equal.

23*d*. Pulsation raises up the sternal end of the left clavicle. Apex beat is not visible. A loud, rough systolic murmur of a rubbing or grating character is heard all over the upper chest. A soft diastolic murmur is heard. Spat some blood-stained sputa twice yesterday. Is taking sixty grains of potassium iodide daily.

30*th*. Some dark, clotted blood spat yesterday, with epistaxis. Patient in bed.

May 4. Pulsation decidedly less. Patient in bed.

21*st*. *No pulsation* over area of dulness, which remains the same as before. The left radial appears somewhat weaker than right.

June 11. No pulsation. Patient in bed.

July 13. Patient out of bed. There is a slight visible pulsation. Above the left clavicle is a dull prominence with a thrill. Sixty to eighty grains of potassium iodide daily.

September 10. There is *no pulsation* over area of dulness, which is smaller and the size of a dollar, to the left of the manubrium.

November 11, 1889. For past year patient has been doing well, with no severe symptom of any kind; has been about his work as foreman of masons. No dyspnœa. Not much pain. To-day is suffering from an attack of acute bronchitis. On lying down he feels as though something were dragging at throat.

December 4th. Has been doing well. To-day without any severe cough the expectoration began to be tinged with blood. Superiorly and posteriorly over the left apex there is feeble breathing; no other sign.

January 13, 1890. For past week had an attack of bronchitis, with no other sign. To-day find him with pain under right nipple and a friction-sound at this point.

November 5. Whole upper part of chest heaves with action of heart, especially at the articulation of the left clavicle with the sternum. There is a diastolic murmur, becoming louder at aortic cartilage and conducted down the sternum. At the apex of the heart there is a faint diastolic murmur, which is transmitted. There is no systolic murmur; there is no difficulty in deglutition; there is tracheal tugging.

Laryngoscopic examination shows paralysis of left vocal band. Heart's apex in sixth interspace just outside nipple. An epigastric impulse can be seen. The præcordium is prominent.

There is dulness under the left clavicular-sternal joint, extending to within one-half of an inch of right of sternum, just above clavicle, to right of sternum one inch, and to second rib.

May 30, 1891. For past year patient has been continually at work, but complains much of pain in left chest and shooting down left arm. At the left costo-sternal junction is a prominence which pulsates synchronously with the heart-beat. Dulness corresponds to this, and measures four inches by three inches. Over this region a distinct double murmur is heard. It is very loud at the left border of sternum, but has its greatest intensity for both murmurs at the *right* border of sternum and the third rib. It is exceedingly loud along the right border of sternum to the margin of ribs; along the left border of sternum it can scarcely be heard below the second rib. The double murmur is heard in the vessels of neck. The præcordium bulges. Heart dulness is one-half inch outside nipple, fourth rib, and left border of sternum. There is no dysphagia. There is considerable dyspnœa and pain. Pulse is not markedly "Corrigan."

August 19th. Patient died suddenly after going to bed last night. For the past two months he had been having considerable pain, but was no worse than

usual. He went to bed and arose to urinate; there was no straining, but he suddenly fell backward and expired almost instantly.

Autopsy, twenty-four hours after death.—Præcordium somewhat prominent, especially near the sternum. On opening the cavity of the chest a considerable amount of serum exuded from the left side. All the organs were displaced to the right. The left lung was floated upward, and when pulled aside the left thoracic cavity was seen to be filled to two inches above the level of the spine with blood and serum. The liquid when removed consisted of sixty ounces of serum and clotted blood.

A mass the size of two fists, occupying the seat of the arch of the aorta, was found to be adherent from mid-sternum in first interspace out on a line to mid-clavicle upward to the middle of clavicle and backward on a level with the first rib. The apex of the right lung was firmly adherent. There were hypostatic congestion and œdema of right lung, and adhesions between upper, middle, and lower lobes. Spleen small, flabby, and pale. Left kidney rather small; capsule slightly adherent, is mottled and the cut surface is anæmic. Relation of cortex and pyramids is normal. The mass, which proved to be the dilated aorta, was removed and examined at leisure. The heart was also removed.

Heart: Both ventricles dilated, especially the left, which bulges far into the right. Left ventricle: width, when open, six inches; length, four and one-half inches.

Aorta measures four inches in circumference just above the valves. Two inches above, it measures five inches. Aortic valves are thin and normal. Heart muscle is very soft and pale, with considerable post-mortem softening. The tips of the papillary muscle are fibroid. Coronary arteries are healthy. Aorta is thin and irregularly dilated; it is covered with low atheromatous patches, none of which is recent.

The aneurismal sac begins at the middle of the arch and continues to the bottom of it. The sac will hold the hand loosely open, and is a dilatation of the whole arch. There is a distance of two and one-half inches between the left carotid and the subclavian. The left lung is adherent to the sac, over an area of five by five inches. The adhesions are old and firm, and the lung is spread out in a thin layer over the adherent portion of the sac.

The sac is empty; there is no trace of an organized clot. In some spots there are small recent clots, and one of these, in the anterior part of the sac where the lung is adherent, fills a round cavity which proves to be a healed ulcer, the base of which is the lung. It is one-fourth of an inch in diameter. Further back is another healed ulcer, which is half an inch in diameter. It is shallower than the other, but shows lung tissue at the bottom.

One inch from the lower end of the sac, on its concavity, is a recent laceration, one and a half inches long, with irregular edges and somewhat S-shaped. It involves all the coats of the vessel, and opens to the lung. A passage leading from this opening runs down and back between the aorta

and lung, and finds exit at the beginning of the thoracic aorta. Just beneath the pleura the tract contains a clot about three inches long and half an inch wide.

An old and severe rupture of the intima is seen on the convexity, running from the recent laceration toward the subclavian. It is two inches long and one-half to three-fourths of an inch wide. It involves only the intima, and is perfectly healed. The adventitia at this spot is strongly reinforced by the adhesions. The thoracic aorta is two and a half inches wide when open. Its surface is wrinkled and shows numerous atheromatous patches, and at the lower end a calcareous plate, one-half by one-fourth of an inch in dimension.

This case is remarkable in several particulars :

First. The rather unusual time through which the case was watched, and finally a section made.

Second. The severe hemorrhage, which did not prove fatal. This hemorrhage doubtless took place through the small ulcers over the adherent lung. The blood that was coughed up was frothy, and that lung showed changes after the hemorrhage.

Third. The action of the potassium iodide. It was supposed, after the hemorrhage and while the pulsation disappeared to a great extent, that coagulation had taken place in the sac. This, as proved by the necropsy, was not the fact. There was not a sign of an organized clot in the sac. The iodide probably did relieve the pain and also cut short the atheromatous process. There is no recent atheromatous ulcer. The rupture doubtless took place through an old scar.

It is worth noting the great amount of iodide taken by the patient without producing any sign of iodism. He positively denied syphilis, and there is no reason to suppose he falsified. The iodide doubtless lowered the tension in the arteries, and in that way helped to prolong life.

Fourth. The good effects of rest, as shown by the diminution of the tumor and lessened pulsation while in bed.

Fifth. The variability of the murmurs heard. These notes were made either by Dr. Doek or myself, and hence the differences are in the murmur and not due to differences in observers. At the first visit, July, 1887, there was a diastolic murmur, but no systolic murmur. August, 1887, a double murmur was noticed over the tumor ; the systolic long and loud. March, 1888, the double mur-

mur persisted. April, 1888, the systolic murmur was rough and grating in character; the diastolic soft and less distinct. November, 1890, there was no sign of a systolic murmur, but the diastolic persisted. May, 1891, the last note; there was a loud *double* murmur.

This difference in murmurs which are apparently organic in character, is, of course, not unheard of. I have noticed the same thing more than once in cases of undoubted organic disease of the heart. I have never seen any explanation of the phenomenon, but suppose it to be due to differences of tension in the vessels at the time of the different observations.

EXPERIMENTS IN PNEUMONECTOMY AND PNEUMONOTOMY.

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[Read November 4, 1891.]

THE results that have followed the application of correct surgical principles in the evacuation of purulent accumulations in the pleural cavity, either by drainage or by the resection of one or more ribs, certainly invite us to still further invasion of the thoracic cavity. With the advances in surgery made possible by increased knowledge, by improved technique, and by the application of safe antiseptic measures, further success may be expected.

Operations for abscess of the lung substance, for gangrene, tumors, cysts, etc., are increasing, and many successes are recorded. In this class of cases the resulting inflammation, as a rule, has bound the lung to the thoracic wall before the surgeon has attempted to enter the diseased area; hence, operative infection of the pleural cavity is not probable, although the disease may have invaded this space before any incision is attempted.

Tubercular abscesses with slight resulting pleurisy do not, as a rule, unite the lung to the costal pleura, and any invasion through the two separated pleural layers would necessarily lead to contamination of the pleural sac.

It has long been my hope and expectation that tubercular abscess in the lung would be reached, drained, and locally treated. If adhesion has taken place, such invasion would be feasible; but in many cases, especially at the apex, adhesion of the two surfaces does not occur. In these cases, therefore, primary operation

becomes necessary in order to secure adhesion and a direct communication with the outer world, which route should be walled in so thoroughly that the tubercular material cannot infiltrate either the pleural cavity or the general system.

The following experiments were performed to test the possibility of the production primarily of such adhesion, and also to determine the tolerance of the lung to secondary incision into its tissue.

One of the plans adopted was to drag the lung into the chest incision and secure it firmly *in situ*, causing it thus to form a firm plug at the opening, which plug should become firmly adherent around the circumference. By this method free escape of the diseased product could be primarily secured while the pleural cavity would be shut off.

Another method consisted in lightly suturing the opposing pleural surfaces, in order to produce an adhesive inflammation.

These experiments are too few in number to give a positive result, but, taken in connection with my experiments in bronchotomy through the chest-wall (*Amer. Journ. Med. Sci.*, December, 1891; *Trans. Amer. Surg. Assoc.*, 1891), they show the existence in the dog of a remarkable tolerance to lung interference.

Experiment I.[1] *Primary suturing of lung; secondary pneumonotomy; recovery.*—A small-sized Scotch terrier, male, was etherized, shaved, and scrubbed with sublimate solution. An incision was made on the left side between the fifth and sixth ribs. There was no hemorrhage when the pectorals and intercostals were divided. There was partial collapse when the pleural cavity was opened; ether was then suspended. The lower lobe of the lung was caught with blunt hæmostatic forceps, drawn to the opening, and sutured to the circumference with chromicized catgut. There was no bleeding from the muscular tissues, and but little from the needle-holes in the lung. The wound was sutured with silk, cleansed with sublimate solution, and dressed with iodoform and collodion. The dog was in bad condition and breathing rapidly, but he walked about in ten minutes.

On the following day the dog was perfectly well, and apparently had suffered nothing from the wound. On the ninth day the stitches had given way, and the wound was accordingly opened. It presented a granulating surface covered with healthy pus. The pectoral muscle, which had united, was torn through with the finger. The adhesions around the opening were

[1] For most helpful assistance in these experiments I am indebted to Drs. Joseph Sailer and W. M. Hinkle, and to Mr. William R. Nicholson, Jr.

found firm and strong. The lung was adherent to the thoracic wall, but during the manipulations these adhesions were partially torn.

An incision was made into the lung substance for about one-third of an inch in depth. Hemorrhage was very profuse for a few minutes, but steadily lessened. The incision was packed with a roll of sublimate cotton, and from that time there was no further bleeding. The edges of the wound were drawn loosely together and a roll of cotton placed at the exit.

The dog had no fever, and continued well. On the third day it was found that he had removed the plug, but no hemorrhage followed, and he remained in good condition. A pair of forceps, which were carried into the wound to search for the plug, drew out a large clot. It was not offensive, but its removal was followed by a free hemorrhage for a few minutes.

The dog was killed at the end of the fourth week. The wound had entirely healed, and he had never been sick or lost his appetite since the second day. The lung was found closely adherent everywhere about the wound, with firm cicatrices of the lung substance where it had been incised. There was no sign of pus anywhere. The pleura was smooth and perfectly healthy, and there was no effusion. There was only the ordinary amount of normal serum, and no roughness or lymph. The membrane was smooth and glistening, and there was no inflammatory trouble in the lung tissue around the site of the operation.

Experiment II. *Suturing of lung; adhesion of pleural surfaces; secondary pneumonotomy, followed by septic infection from accidental rupture of adhesions.*—A black and white spaniel, of moderate size, was etherized, shaved, and cleansed. Incision was made between the seventh and eighth ribs on the left side, and the intercostal muscles laid bare. Without opening the thorax, a chromicized catgut ligature was carried through the muscles, then through the lung, by a handled, sharply-curved needle. Two sutures were inserted. The wound was closed antiseptically with silk sutures, and dressed with iodoform and collodion. The dog rallied in about five minutes. The animal was in good condition, and did fairly well until the tenth day, when the wound was re-opened. The pleura was found adherent with considerable firmness to the lung at the line of suture between the seventh and eighth ribs.

An incision was made into the substance of the lung. Bleeding was slight, and was arrested by simply packing the wound. Some of the adhesions were accidentally broken down, which permitted the entrance of air into the cavity, and probably of some drops of pus from the granulating surface. The wound was freshened, sutured, and closed. Purulent infection, however, from the opening into the pleural cavity spread and induced septic pleurisy, from which the dog died on the second day following.

The serous cavity contained a large amount of fetid pus, and the lung had collapsed. The adhesions around the site of operation had, of course, entirely given away under the suppurative process. The wound had not closed.

An error was probably made in rupturing the adhesions and then in attempting to induce reunion of the wound by paring away all the granulation tissue, freshening the surface, and reuniting the skin with sutures, as these methods were productive of inflammation.

Dogs are so restless under any dressing that it is impossible to keep them aseptic, except by fixing the antiseptic dressings with a bandage of gypsum.

Experiment III. *Attempt to produce adhesive inflammation of the pleura by Paquelin cautery.*—A white, stout, moderate-sized, black mongrel was etherized, shaved, and disinfected. Incision was made on the left side near the fifth interspace down to the intercostal muscles. A Paquelin cautery was employed, but, as usual, the knife failed to work properly, and cooled so rapidly that it was useless. I had with me at the time only one other cautery-point, a large, round-headed one, and with this the perforation of the intercostal muscles was slow. The lung was undoubtedly pushed before the instrument away from the walls, and the lung substance was not entered. Had the sharp instrument worked properly such perforation might have been possible, but with a dull, round ball the operation was necessarily a failure. As the dog seemed to be suffering, he was killed on the following day. A few drops of pus were found in the pleural cavity. The operation was done to determine whether a route could be rapidly tunnelled into the lung, and at the same time unite the pleural surfaces and permit drainage or subsequent cutting operation.

Experiment IV. *Thoracotomy; pneumonectomy; suturing of lung in the wound; union.*—A small brown and white terrier was etherized, shaved, and disinfected. An attempt was made to perform a thoracotomy and then a bronchotomy. An incision was made through the muscles to the pleura, about three inches of which were exposed in the left seventh interspace. The pleura was incised with resultant pneumothorax. The bronchus of the left side was found, but it was so thoroughly surrounded by the pulmonary vessels that it could not be safely incised. The operation was, therefore, abandoned and pneumonectomy substituted. The lower lobe was drawn out of the opening and a probe passed through it. A ligature was then thrown round the lung and tightened, and the projecting portion of the lung cut off. The ragged edges which interposed were sutured to the interspace and the wound closed as before. The dog recovered in half an hour, and on the following day ate and slept well.

Thirty-five days later the dog was killed, the soft parts having entirely healed. On opening the cicatrix the lung tissue was found in the intercostal space firmly fixed, but healthy. There was no sign of pus at any point. The lung was firmly adherent to the thoracic wall, as shown in the specimen. The pleura was smooth, and there was the usual amount of normal serum in the cavity. The dog did not seem to suffer from the operation.

Experiment V. *Suturing of lung; firm adhesions produced without pleurisy.*—A white and black male dog, weighing eight pounds, was etherized,

cleansed, and prepared as before. An incision was made at the fourth rib, three inches long, extending through the pectoral muscles, but not through the intercostals. With a handled, sharply-curved needle a fine chromicized stitch was carried through the intercostal muscles between the third and fourth ribs and into the lung, emerging one and one-quarter inches nearer the sternum. A similar stitch parallel to the line of the first was carried for the same distance in the interspace between the fourth and fifth ribs. From the point of emergence of these stitches cross stitches were carried in a similar manner, the needle being pushed into the third interspace through the lung beneath the rib, emerging at the fourth interspace. These were lightly drawn, so as not to cut through the lung, but simply to approximate the visceral and parietal pleuræ without producing any sloughing of the lung or of the muscles. A parallelogram of lung was thus brought closely against the walls of the chest, and the opposing pleural surfaces were constantly in apposition. The muscles and skin were separately stitched and iodized collodion applied over all. The dog seemed to suffer no inconvenience and rallied quickly. He appeared perfectly well until he was killed on the tenth day. At the autopsy the pleural surfaces were firmly adherent throughout the whole extent. There was no roughening of the pleura, no effusion of serum, or any evidence whatever of lung injury.

Experiment VI. *Suturing of lung without opening into the pleura; excellent adhesions.*—In a white male pup, weighing six pounds, incision was made on the left side over the fourth rib. The pectoral muscles were divided, but the intercostals were not cut. A handled, sharply-curved needle, threaded with chromicized catgut, was passed through the fourth interspace into the lung and out through the intercostal muscle one and one-half inches higher. This was tied just sufficiently tight to keep the two pleural surfaces in apposition, but not to produce sloughing. A parallel suture was similarly placed in the third interspace, and cross sutures were carried beneath the rib from one interspace to the other at the ends of each. The lung was thus brought in apposition with the parietal pleura by sutures on the four sides of a parallelogram. The pectoral muscles were then sutured continuously, and the wound closed with interrupted sutures. The dog rallied and seemed in good condition half an hour later. When killed, twenty days later, the pleural surfaces were found to have united with great firmness, and, other than the adhesions, there was no evidence whatever of pleurisy. The lung substance presented no evidence of inflammation.

Dr. Sailer and Messrs. Patek and Bolgiano[1] reported a series of experiments made upon dogs, in order to determine the possibility of operative interference upon the lung.

In their first attempt they cut off a piece of lung and returned

[1] University Medical Magazine, May, 1891, p. 473.

the stump with the ligature into the thoracic cavity. Of four animals experimented upon, one died upon the table, two died the day after the operation, and one died on the fifth day. The autopsies showed gangrene of the stumps and empyema.

A different method of operation was then employed. The lung was drawn out of the thorax, freely cut away, and fastened by antiseptic catgut sutures to the intercostal muscles. The pleura and lung were washed, and the lung sutured in position as a plug at the opening. Sutures were inserted throughout the entire circumference of the wound and the skin incision was then closed over catgut drains.

In three dogs operated upon little hemorrhage occurred and there was but little shock. They reacted well and there was but a slight rise in temperature. The appetite continued good. One dog was killed on the tenth day. There was perfect adhesion to the thoracic wall, without pleurisy. The second dog lived for three weeks. A small cicatrix upon the upper lobe of the lung had become detached from the thoracic wall. In the third dog the whole upper lobe of the left lung was removed. Recovery was prompt and he was permitted to live.

Zakharevitch[1] experimented upon thirteen rabbits and eleven dogs, and made nine operations upon the human cadaver. He resected sub-periosteally from the first to the fourth ribs, and tied the lung off at the root with silk; then cut it away, applied iodoform, stitched the wound, and covered with the usual antiseptic dressings. Of eleven operations upon seven dogs, three were fatal. One dog lived four years after the second operation, then died of accident. On examination, the remaining part of the lung was always found enlarged and developed. If one lung is sound, the chances of a dog even after total pneumonectomy of one side are good; if the remaining lung is weak, then the dog usually perishes. In thirteen operations on nine rabbits, two were fatal.

As the roots of the upper and middle lobes of the lung are opposite to the third interspace, and that of the lower lobe to the fourth interspace, Zakharevitch recommends excision of the second rib to

[1] Annual of the Universal Medical Sciences—Sajous, Philada., 1890, vol. iii. B. 26.

reach the upper two lobes, and of the third rib to reach the lower lobe. For maintaining drainage it is sometimes desirable to open the eighth intercostal space at the posterior axillary line. Free incision and free resection give the best results.

My experiments above detailed, though few in number, prove at least that adhesive inflammation can be induced between the two pleural surfaces by subcutaneous suturing, and that a route of entrance can thus be readily secured; also, that the lung may be incised or a portion of it removed without serious injury to the animal.

The value of these experiments in a surgical view is as yet largely undetermined.

In regard to tubercular abscesses, the resulting inflammation necessarily accompanying the tubercular process will sometimes agglutinate the lung to the thorax and an entrance will thus be easy. When that does not exist, however, a primary entrance can be secured by drawing the lung into the opening after the resection of a couple of the ribs and then suturing it circumferentially at the opening to make a plug; or a primary opening for the purpose of securing adhesion might be performed and the pneumonectomy be made secondarily.

Ledyard[1] localized a tubercular cavity in the lung with probable adhesion and thickening of the pleura. He incised in the fifth interspace at the anterior axillary line; excised the sixth rib, cut into the lung, washed with a boric acid solution, and found a large cavity surrounded with calcareous masses. No serious cough was produced. A drainage-tube was inserted, but the patient died on the sixth day. At the necropsy, the posterior part of the lobe was found adherent everywhere; within it was an oval cavity the size of a goose-egg; the external wall consisted of lung tissue and thickened pleura.

Allis, of Philadelphia, recently resected three ribs opposite the posterior axillary line, opened the pleural cavity, and stitched the lung into the opening. He then incised the lung without hemorrhage, and although reaching a tubercular cavity, found no pus.

[1] Lancet, May 13, 1890.

The child died in forty-five hours. There was no bleeding and the lung substance around the cavities was solidified.

Porter[1] made an opening through the chest wall in a case of fetid abscess of the lung following pneumonia. The fourth, fifth, and sixth ribs were resected for two inches and a half. He had first drained the pleural cavity, but did not reach the lung. In the second attempt, in which resection was performed, the diaphragm was cut and sutured. There was a large amount of pus in the lung. Drainage was free. The fetor of the breath disappeared in a few days, and the man was well in four months, with no cough and no expectoration. Porter records two cases,[2] and says that the condition of abscess of the lung admits of positive diagnosis. It arises from occlusion of an artery from inflammatory conditions which lead to gangrene. Excision of a rib gives the best results, as it makes a free opening for drainage.

In gangrene of the lung, while the results are not very hopeful, yet the benefit to be derived from the operation is sufficient to warrant surgical interference. The operation in such a case gives an opportunity for the escape of material which must otherwise certainly kill the patient. Antiseptic washings ought to be instituted, but they should be exceedingly weak, and probably free washings with distilled water would be equally of service. Removal of the débris and mopping the grangrenous region with peroxide of hydrogen is useful. The dead tissue should be pulled, rather than cut, so as to prevent hemorrhage. Air and hot water act as powerful hæmostatics upon the lungs of dogs, and the same agents have a similar effect upon the human structures. Strong washings should not be continued, since, as is often the effect in empyema, they are not productive of good. The mechanical removal of pus by a stream of hot water is, however, feasible and safe. Thorough attention to details of asepsis and antisepsis is an essential element in all intra-thoracic surgery.

My own experience is in accord with Teale's[3] conclusions, that

[1] Philadelphia Hospital Reports, vol. i. p. 165.

[2] Journal American Medical Association, March 7, 1891; University Medical Magazine, March, 1891, p. 493.

[3] Boston Med. Journ., October 13, 1888.

it is not merely the presence of air in the pleural cavity which gives danger, but that in the healthy lung the great inrush of air that takes place when the chest is opened, seriously interferes with thoracic movements, and is a much more serious matter than when the lungs have been slowly crippled by disease. I have freely opened the chest in a large number of cases of empyema, both with and without excision of the ribs, and have seen no serious result from the pneumothorax produced. In gangrene of the lung, the organ being already crippled, the incision of the thoracic walls may be free. In Allis's case, referred to above, the diseased and solidified lung did not collapse when the pleura was opened. In deep abscesses the Paquelin cautery to provoke adhesion of pleural surfaces, might be useful; but in gangrene the plan adopted by Hofmokl, that of penetration with the Paquelin cautery,[1] does not seem wise, as free escape is best.

Osler[2] reports a case of bronchiectasis, in which the patient had felt a sensation of fulness in the left side for many years, although there was no especial difference in appearance in the two sides of the chest. The sputa were purulent and moist, with fetid pus; no elastic tissue or tubercle bacillus could be discovered. Portions of the fourth and sixth ribs were excised and the cavity opened and stitched. The patient died on the third day.

Laaeke records an operation for bronchiectasis, in which the patient lived for eighteen months and then died of brain trouble.

Several cases are reported of incision made for pneumonia with recovery of the patient. The ribs excised were in the axillary line; antiseptic dressings were used and the patients recovered.

B., aged twenty. An incision was made in the fifth interspace through the left anterior axillary line. The sixth rib was excised; the lung cavity was incised and washed with boric acid. The cavity was found to be surrounded with a caseous mass. Drainage-tubes were inserted. The patient died on the fourth day. *Post-mortem:* Left lung adherent everywhere.

Koch[3] made an incision into the lung substance for pleuro-pneumonia, having resected the fifth and sixth ribs. The thermo-cautery was used to reach the abscess. Irrigation and drainage were prac-

[1] Annual of the Universal Medical Sciences—Sajous, 1889, N. 9.

[2] Bronchiectasis, Johns Hopkins Bulletin, 1889 and 1890, p. 109.

[3] Annual of the Universal Medical Sciences—Sajous, 1890, vol. iii. B. 26.

tised. The patient was well in eighty-one days. One and a half years later, the patient was reported as being in good condition.

Vinesse[1] advises against too extensive a resection, and Ollier states that in young and hearty subjects excess of periosteum should not be left, as it is likely to produce bone.

Bull[2] reports two cases of gangrene operated upon; and Thue, in the same journal,[3] gives other cases successfully drained, although one patient subsequently died of pericarditis.

Jones has operated on three cases of abscess of the lung, and considers alcoholism as the chief factor of the disease. Lassier, of Kiel, reports six cases; Ruenberg eight—all operated on. With Jones's three, there have been thirty cases, exclusive of Graves's six successful ones.

Conclusions.—1. The writer's experiments in thoracotomy and in bronchotomy[4] show that the entrance of air into the pleural sac is a far more serious matter when the lung tissue is normal than when it is diseased or already crippled, both as regards the collapse of the lung and the danger to the patient.

2. Incision into the substance of the lung and removal of a portion is well borne in dogs. Hemorrhage, though free, is not fatal, and can be arrested by packing.

3. Adhesion of the parietal and visceral layers can readily be obtained by sutures, and the resulting pleurisy is slight.

4. Surgically these experiments demonstrate that adhesive inflammation can be secured, thus permiting safe incision into tubercular or other diseased lung tissue without infection of the pleural sac.

5. A lung can be drawn into the wound made by excision of the ribs, and so sutured to the edges of the opening that the pleural cavity can be cut off.

6. Pulmonectomy performed for gangrene or for abscess of the lung offers better results than are possible in cases not treated surgically.

[1] Congress Française de Chirurgie, 1889, p. 219.

[2] Norsk Mag. f. Laegevidensk. Christiania, 1891, 4 R. vi. p. 289.

[3] Norsk Mag. f. Laegevidensk, p. 271.

[4] American Journal of the Medical Sciences, December, 1891; Transactions of the American Surgical Association, 1891.

TARDY HEREDITARY SYPHILIS OF THE BONES.

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[Read November 4, 1891.]

Four cases of this not very common affection have recently come under my notice. As its true nature is quite likely to pass unrecognized and mistakes in treatment be made, and as these cases happen to be so typical, I have thought them of sufficient interest to be presented to the consideration of the Fellows of the College.

Case I. is that of R. B. D., a boy aged fifteen years. He presented himself at the Orthopædic Hospital with an enlargement of the left tibia accompanied by considerable pain. His history is as follows: He is one of a family of fourteen children, nine of whom died in infancy. One of these nine died of hydrocephalus; the causes of death of the others are unknown. One of the five children left, a girl, lived to the age of eleven years, and had an affection of the legs similar to that presented by this patient. She was also at one time deaf and blind, but these troubles improved under treatment. She is said to have died of membranous croup. The other surviving children appear to be healthy.

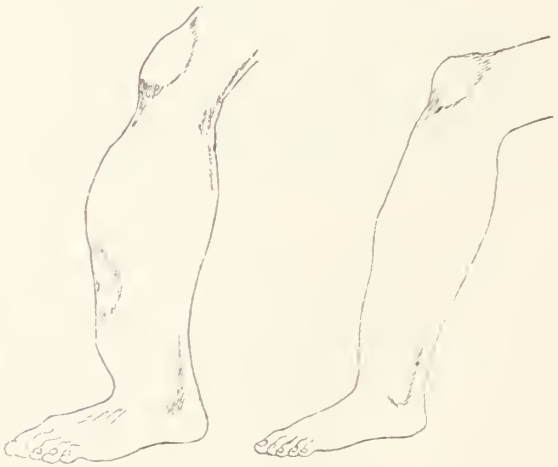
The mother has had five miscarriages, and the father confesses to having had syphilis: but claims that it was contracted after the birth of the other affected child. There is a history both of a primary sore and skin eruptions. About eight years ago, when the patient was seven years of age, he was kicked on the left shin by a boy. The leg then began to swell and to pain him, particularly at night. The swelling has gone on increasing and the pain still troubles him. He has been rubbing the leg with liniments, but has never been treated by a physician.

On examination the left tibia is found much enlarged, particularly forward, and bent to a slight extent inward. The thickening begins above the ankle and extends to near the tuberosity. There is a superficial ulcer on the front

of the leg, half way up to the knee. The left extremity as a whole appears to be two inches longer than the right one. The inner side of the left tibia measures over two inches more than right, and its anterior surface is two and one-half inches longer than that of the tibia of the opposite leg. The fibula does not appear to be at all affected. This increased length of the left leg has caused the pelvis to be tilted, and produced a curvature of the lumbar spine with the convexity toward the right, and a compensatory curve in the dorsal region with the convexity toward the left. The left knee is bent inward in a genu-valgum position, and the foot is markedly abducted or in a state of valgus. Three years ago he was struck by a stone on the right leg above the external malleolus. The injured part began to pain and swell, and the fibula of the right side is now enlarged for the space of six inches above the ankle-joint. The enlargement, however, is not so marked as that of the tibia of the opposite leg. No other bone is affected, and the teeth are neither pegged nor notched although somewhat uneven. The boy is thin, ill nourished, and somewhat nervous. The deformity of the left leg of this patient is shown in Fig. 1.

A marked feature of the case was its high and irregular temperature, varying at times as much as five degrees in twelve hours. The boy was treated with the syrup of iron iodide, and later with mercury bichloride and potassium iodide. He improved at times, but eventually left the hospital not much better than when he entered.

FIG. 1. FIG. 2.



CASE II.—Wm. P., a boy aged thirteen years, was admitted into the hospital under Dr. Goodman's care. When eight years of age, during the

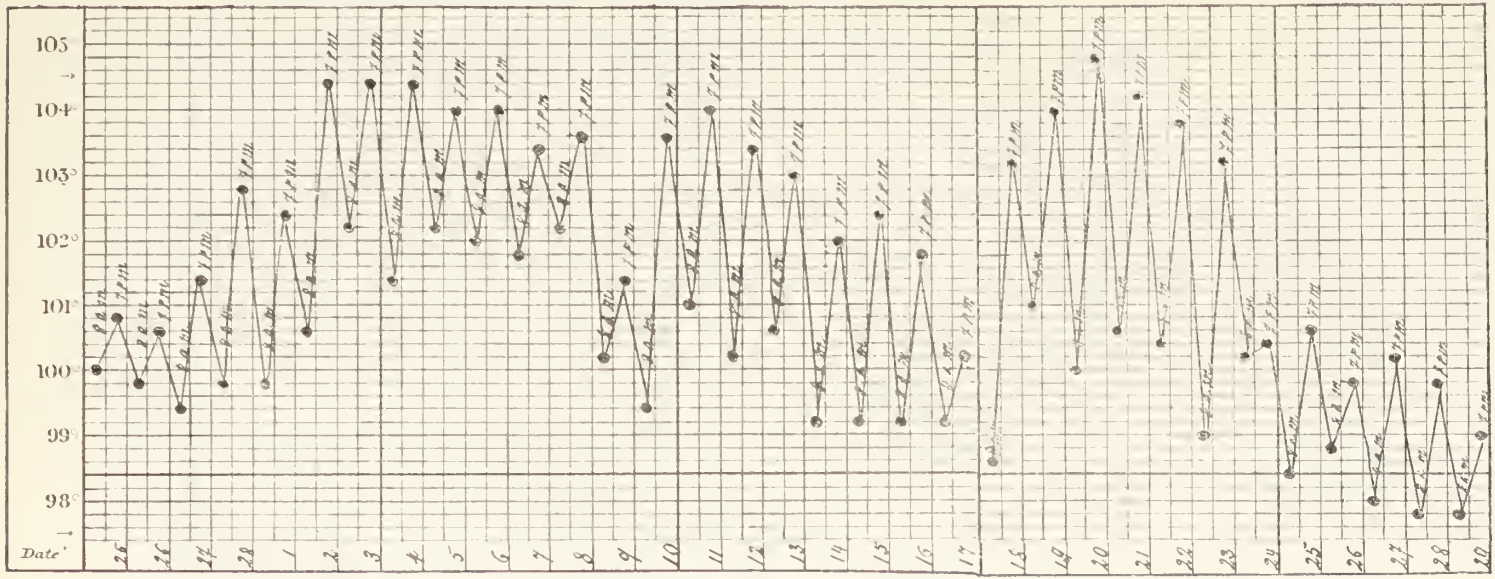
summer-time, he began to have pain in one of his wrists. He denied having injured the part, and there was no change in its external appearance. A week later he had pain in all parts of the body. These pains continued all that fall and winter. They were present, more or less, all the time, but became worse after four o'clock in the afternoon. He was also chilly and wanted to be near the fire. The affection was supposed to be rheumatism, but treatment for that condition gave no relief. In the following summer the pain ceased, and both tibiæ began to enlarge. The ankles and knees, at this time, were also thought to be affected. The bones of the left forearm, too, began to get larger. Since then he has had pain, off and on; it is worse before and after wet weather. At no time has he had an eruption on his body or trouble with his eyes or ears. His teeth are good, strong, and even.

His mother gave the following family history: She has had fourteen children, the patient being the seventh; of these, ten are living; the other living children are healthy Of the four dead, one was killed by a gunshot wound at the age of three years, and another died of some disease of the stomach at the age of five. The remaining two died at the age of two and four days respectively; the physician in attendance said that there was something wrong with their hearts. One and a half years ago she had a miscarriage at five months. She does not know any cause for it, and it is the only one she has had. The father is strong and hearty. He has not had any eruption on the skin, and the only illness he has experienced was six years ago, when he was very sick for four weeks. He was hoarse, and the attack was thought to be bronchitis. The children did not suffer in infancy from snuffles or eruptions of any kind or from sore eyes.

On the admission of the patient into the Orthopædic Hospital both bones of the left forearm were the seat of a fusiform enlargement. Both legs were likewise enlarged, as seen in the illustration of the left leg (Fig. 2). The foot of this leg also showed some valgus. Before he entered the hospital he fell and hurt himself, and a purple spot showed itself above the right ankle. He remained in the hospital four or five weeks and, after leaving, this spot broke down, and his physician, Dr. Miller, removed a large sequestrum. A year and a half later the swollen part below the knee of the right leg became quite red and painful, and looked as if it were about to suppurate. While in the hospital this patient was treated with potassium iodide and phenacetin, and, at times, for his fever, sodium salicylate. On leaving the hospital his acute symptoms had somewhat subsided, but otherwise he was about the same. His temperature is shown by the accompanying chart (Fig. 3).

Case III.—Willie S., a boy aged eleven years; had been ailing for five years. He has had pains in his arms and legs, particularly the latter. These were thought to be rheumatic. He has been steadily getting worse, and now his legs are very much deformed, as are also his forearms. He has limped for the past two years. There is a valgoid condition of both feet, the left

Fig. 3.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being the more marked. While under treatment he complained of a "cold" in the nose and throat. The cervical glands enlarged enormously, but after three or four weeks the swelling subsided. Later, a large node appeared in the course of a single week on the left fibula just above the external malleolus, but immediately began to subside.

Fig. 4.

Fig. 5.

The father admits having had gonorrhœa when young, but denies having had any symptom of syphilis.

The mother states that there are two other children, now aged fourteen and sixteen years; they are and have been perfectly healthy. She has had three other children; two of these died of "water on the brain," one at the age of three months and the other at seven weeks; the third was stillborn. The head of this last child was also said to have been larger than was natural. She has had no miscarriage. Her husband has had no illness excepting rheumatism, from which he is getting better. The patient has a lupoid scar under the right eye, said to be from an abscess, and another on the side of the head measuring three-quarters by one and a half inches. His legs increased gradually in size until they presented the appearance shown in Fig. 4. The forearms are likewise enlarged, but he has no pain except in the legs. He was not affected with snuffles in infancy nor had he any eruption.

This patient was placed on syrup of iron iodide (gtt. xx, t. i. d.), and later was given potassium iodide, five grains, and mercury bichloride, one-thirty-second of a grain, after meals, and compound syrup of the hypophosphites (U. S. P.), before meals. Improvement has been marked and

satisfactory. The arms have been reduced nearly to their normal size, and the size of the legs has also decreased. Febrile disturbance has never been marked in this case. Lately, however, a new node made its appearance on his left fibula as already described, but decreased much in size.

Case IV.—Wm. W., a boy aged thirteen years, was well until four years ago, when he was under treatment for disease of the right ankle. One year later the left ankle began to swell, pain was severe, and he walked with great difficulty; at times he could not walk at all. He has also had pains in the left knee and hip, both in winter and summer. There is one scar on the outer side of the left tibia, and two on its inner posterior surface. These were discharging eight months ago. The inner side of the right tibia is three-eighths of an inch longer than that of the left tibia, causing the foot to assume a position of extreme valgus (Fig. 5). His mother has had eight children, he being the fourth. Six are living, one died of scarlet fever, and one was stillborn. No syphilitic history could be traced in either parent. The patient was given potassium iodide, and in about six weeks the left tibia was reduced to its normal size and all pain in it ceased. The right tibia, however, soon after suppurated and discharged three or four minute granules of bone, and still later an ulcer appeared on the right heel near the tendo Achillis. Later, one-thirty-second of a grain of mercury bichloride was given in addition to the potassium iodide.

These cases are well-marked examples of an hereditary syphilitic taint which is tardy in its manifestations. The affection is to be distinguished from ordinary inherited syphilis because in it the manifestations of the disease occur usually during the first three months after birth, while in tardy hereditary syphilis the symptoms may show themselves in childhood, youth, or even early adult age. In these cases the signs first showed themselves at the ages of seven, eight, six, and nine years respectively. Fournier (*Syphilis Hérédi-taire Tardive*, Paris, 1886, p. 253) describes one case, that of a young man, who was attacked at the age of twenty-six years. Of course, tardy hereditary syphilis can manifest itself by affecting other tissues than the bones, but they are second in the order of structures most frequently affected. Eye troubles are the most common, embracing nearly one-half of all the cases, while the bones, according to Fournier, are affected in 38 per cent. The tibia is the bone most commonly attacked, and was affected in all the four cases here given.

In cases in which a syphilitic taint is suspected we naturally turn to the previous history of the patient, if he is an adult, and to

that of the parents, if the patient be a child. The tardy or late manifestations of syphilis appear to be the last evidences that can be definitely attributed to the syphilitic infection. When it is attempted to attribute such lesions as are commonly regarded as scrofulous or rhachitic to the result of an hereditary syphilitic taint, then we simply wander in a speculative region about which nothing definite is known. It is, I think, a recognized fact that, as the duration of a disease is extended, so do the efficacy of purely specific remedies diminish, and certain it is that purely anti-syphilitic treatment has not demonstrated its value in scrofulous or rhachitic affections.

While the peculiarity of the manifestations of the disease in the patient may establish the diagnosis positively, it still often occurs that a typical syphilitic history cannot be traced in the parents. This is only to be expected, because we should remember that we are dealing with the manifestations of a disease that is on the point of losing its specific characteristics and, therefore, does not exist in a virulent form. As the disease varies in intensity in different individuals, so we are apt to find the history to be a more or less typical one. In some, the more we search the more numerous do we find the evidences of the syphilitic taint, and in nearly all some corroborative fact can be discovered. In the first case we find nine out of fourteen children dying in infancy; in the second, two out of fourteen; in the third, three out of six, and in the fourth only one out of eight. A large infant mortality is characteristic of syphilitic parents, and in the first case this is markedly shown, but not so in the others, although three out of six in the third case is certainly suspicious.

Examining into the causes of death of these eleven infants, we find that of the first five, one died of hydrocephalus, while the causes of the death of the other four are unknown. Of the second group we find that the attending physician said the two infants died of heart trouble; they lived to the ages of two and four days respectively. Of the three children of the third group, two died of water on the brain, and the third was stillborn. Of the last family the one that was lost was stillborn. Haase (*Allg. med. Annal.*, Altenberg, Feb., 1829) and Lanceraux (*Syd. Soc. Transl*, London,

1869, vol. ii. p. 162) state that hydrocephalus is occasionally associated with hereditary syphilis, and here we find three out of eleven children dying of it, and even one of the stillborn children had a head larger than normal. It suggests the possibility that some of the cases of hydrocephalus which live much longer than these did, may be due to a similar specific poison, although, perhaps, in a more attenuated and less virulent form.

Miscarriages are also symptomatic of the affection. We find that the mother of the first patient had five; of the second, one; and each of the other two had one child stillborn. A clear syphilitic history of primary sore and skin eruption was obtained from the father of the first patient, but he claims they appeared after the birth of a sister of our patient who was similarly affected, but he is probably mistaken. There was no syphilitic history on the mother's side. In the second case there was no specific history on either side, the father's only ailment having been an attack of what was supposed to be bronchitis, which disabled him for four weeks. It is possible that this may have been a specific sore-throat. The parents of the third child deny all specific symptoms, the father admitting only that he had had, while young, an attack of gonorrhœa. No evidence of a syphilitic history could be obtained from the parents of the fourth child. The occurrence of osseous lesions, such as are present in these cases, have so frequently been observed in connection with other manifestations of the disease, and in cases in which the whole chain of evidence is complete, that there cannot be the slightest doubt as to their cause. Such cases are given by Fournier, Hutchinson, and others, and the first patient here presented is also one of that character. I have lately had referred to me a young married woman, aged twenty-seven, who, at the age of ten years, had an undoubted syphilitic ulceration of the throat, the soft palate being destroyed. This was followed later by syphilitic disease of the eyes, and from the age of twelve she has had trouble with one of her shins; it is tender and roughened even yet, and has probably been the seat of a syphilitic node. The pain which exists in these cases is an important symptom. It begins when the patient goes to bed and is less or altogether absent when he is up and about. It is said to be caused by

the warmth of the bed-clothes, and that, if the patient sleeps in the daytime he will have the pains at that time, instead of during the night. In Case II. the pains began to get worse from four o'clock in the afternoon. The pains usually precede the enlargement of the bones, and at this stage the disease is very apt to be considered as rheumatic. This occurred in some of these cases. The disease may either affect the bones near the epiphyseal cartilage or else the shaft. When the neighborhood of the cartilage is affected the growth of new, though not healthy, bone is rapid—in fact so rapid as to produce very marked deformities

The tibia being often affected while the fibula remains healthy causes the foot to be thrown into a position of valgus. This was markedly the case with the left foot of Case I., the left foot of Case II., the left foot of Case III., and particularly the right foot of Case IV. Mr. Hutchinson (*Medical Times and Gazette*, March, 1879, p. 348) details the case of a girl, aged seventeen, who had an enlargement of the middle of the femur which caused lengthening of the member. This shows that the increase in the length of the limb in these cases is not due to an increased activity of growth solely at the region of the epiphyseal cartilage, but that it likewise takes place in the diaphysis. Spontaneous fracture of the bone occurred in this case.

It is natural to look for other evidences of syphilis in the patient, such as notching of the teeth, but one should not necessarily expect to find them. Of course, some cases occur in which there has been a variety of lesions. Thus the sister of our first patient had had both ocular and aural affections in addition to the bony lesions; also in the case I have already mentioned there were lesions of the throat, nose, and eye, in addition to the trouble with the tibia; but this is not commonly the case, and the teeth are not likely to be affected. None of these four cases showed notching.

A valuable diagnostic point is the multiplicity of the lesions, these being often symmetrical. In the first case the tibia of one extremity and the fibula of another were affected. In the second the ulna and radius of one arm and both tibiæ; in the third both tibiæ and one fibula and the ulna and radius of each arm, and in the fourth case both tibiæ.

The pathological process occurring in the bones is usually chronic, but at times it presents exacerbations with marked sthenic symptoms; severe pains, tenderness on pressure, increase in size of the part, redness, œdema, high fever, and even suppuration followed by necrosis—all may occur.

The first patient, a boy, aged fifteen years, had all these symptoms, and his fever was both high and irregular, varying from two to five degrees during the day and rising to one hundred and three degrees on an average. The second patient also, a boy aged eleven years, had marked febrile disturbances, as shown in the accompanying chart (Fig. 3), the daily variation being from two to four and four-fifths degrees. The third and fourth cases pursued a more chronic course, with very little febrile disturbance.

The nodes appear sometimes to be started by an injury, as occurred in the first case, but this is not a usual occurrence. The disease affects both the periosteum and the bone itself. The rapid appearance of some nodes, as seen in the one occurring on the fibula of the third patient, and those shown by the unevenness of the crest of the tibia in some of the others, demonstrates the fact that the periosteum is markedly enlarged, together with the superficial layers of bone. The body of the bone itself is also often affected. This at first is the seat of a rarefying osteitis; the bone becomes softened, and may even, as in Mr. Hutchinson's case above mentioned, break spontaneously. The skin is not infrequently discolored, and large, blue veins can be seen wending their way beneath it. As the activity of the disease ceases, if the bony changes have not been too marked, much of the deformity may disappear. The forearms of the third boy mentioned have almost, if not quite, returned to their normal condition and his legs likewise have much improved. The bones of the forearm of the second case retain their deformed condition; the disease, however, was still at times active. Later, a condition of sclerosis of the bones may occur, and further change in their form will only be such as is due to their subsequent growth.

When suppuration occurs, it may take place either with considerable, or little, disturbance. If the first is the case the swelling is likely to occur quickly, the skin becomes red, fluctuation occurs,

and spontaneous opening takes place, with not much discharge of pus; the bone quickly becomes bare and exfoliation of a superficial scale may be quite rapid, although if the bone is deeply involved the necrosed piece may long remain attached at one of its extremities. If, on the other hand, the process is more chronic, a cold abscess forms, with a scanty amount of pus; spontaneous perforation soon occurs and small granules of bone are discharged—as in the fourth case mentioned—and healing soon takes place, leaving a scar. The process differs considerably in its course from that of tuberculous or strumous disease. In the latter the course of the carious or necrotic disease is much slower, a larger, thicker mass of bone is involved, and the sequestrum comes more from the body of the bone. The sinus may also continue discharging for months and even years, the disease remaining apparently in *statu quo*. In these syphilitic affections, however, the course, both in its onset and decline, is more abrupt. Of course, as mentioned above, exceptional cases do occur in which, from the depth to which the bone is affected, separation of the sequestrum is much slower than is ordinarily the case. There is a difference also in the appearance of the patients. The syphilitic ones are usually thin, pale, ill-nourished subjects, while those with ordinary necrosis are often in quite good general health and certainly have a much better appearance than that of the marasmic-looking subjects of hereditary syphilis.

In regard to the treatment of the affection, mercury and potassium iodide are certainly the most useful medicines. The rapidity with which the bone-troubles of acquired syphilis yield to the administration of potassium iodide, has caused it to be looked on with deserved favor, and, if one were to estimate its value in the hereditary form solely by that fact and what Fournier says of it, one would expect no trouble in the treatment of these affections after they had once been properly diagnosticated. It remains true, nevertheless, that in many cases the readiness with which an affection responds to treatment is inversely as the amount of time that has elapsed since its acquirement, and, as might be expected, these cases of tardy hereditary syphilis are not so readily curable as are the affections caused by the acquired disease. Mr. Hutchinson recognized this when he said (*Illust. Clin. Surg.*, London, 1875,

vol. i. p. 47) of the nodes of hereditary syphilis that they are not very definitely influenced by the potassium iodide. The first two cases here detailed, received at some time anti-syphilitic treatment, but I was unable to keep sufficient trace of them to definitely determine its value. The first patient was not much improved, while the second was, after a few weeks, bettered to the extent that his acute symptoms subsided, but only to reappear later. Of the last two cases anti-syphilitic treatment has been more continuous and more satisfactory; both have markedly improved, although neither is by any means cured. Mr. Hutchinson says that these nodes, after having lasted a while, may disappear spontaneously, and, therefore, one should not be too ready to attribute to the action of remedies any favorable change that may occur. Anti-syphilitic treatment certainly offers the best hopes of cure and the physician should pursue it faithfully. Personally, I like to give the bichloride of mercury in tincture of the chloride of iron with some syrup, and the iodide of potassium in solution of the strength of a grain to the drop. Syrup of the iodide of iron, syrup of the hypophosphites, and tonics may also be found of service in the intervals when it is desired to suspend the administration of the more specific drugs. I hardly think the treatment should be solely and continuously an anti-syphilitic one, but rather combined with one suitable for strumous affections. Macnamara (*Diseases of the Bones and Joints*, London, 1881, p. 151) holds that while the iodides tend to relieve the pains in the bones, they are not curative, and, therefore, he orders potassium iodide and mercury bichloride together in some syrup. He also advises surgical intervention at times. He states that a subcutaneous incision into a painful node is frequently attended with the greatest relief to the patient, and, when the pains in the bones persist in spite of treatment, he advises exposing them and making a linear incision with Hey's saw. I did not have an opportunity of trying this in the first two cases—in which it would almost certainly have been of service—and in the last two the symptoms improved under treatment to such an extent as to render it unnecessary.

DISCUSSION.

Dr. JOHN ASHHURST, JR.: The paper which Dr. Davis has read seems to me remarkably full and satisfactory. There are one or two points to which I would like to refer; one is the absence of a syphilitic history in several of the cases. It should not be overlooked that occasionally, although rarely, syphilis may manifest itself not only in the second, but even in the third generation, and the disease in some of these cases may therefore have been inherited in this way. A grandparent might have been the original possessor; one of the parents might have inherited the taint in a mild form—not sufficient to attract attention; and in the third generation there might be such manifestations as are here seen, these being rather sequelæ than actual lesions of the disease. We see the same thing in syphilitic manifestations in other parts of the body.

In regard to the diagnosis, this can only be made in many cases by a consideration of probabilities, and, as it were, by exclusion. It is not likely that there should be such a general condition of osteitis, involving so many bones, unless there were some general cause for it. We can exclude rhachitis, because the deformity is different from that which is found in that condition. In syphilis the anterior bowing of the bone is found, as in rhachitis, but there is, in addition, great thickening, and there are not, as a rule, the marked lateral curves which are usually found in rhachitic deformities. We can exclude tuberculosis, because in that affection there would probably be other tuberculous lesions, and even in the bones the disease would not last so long without the occurrence of suppuration and destructive disorganization. We can hardly assign, therefore, any cause but syphilis for such a condition of the bones as is here seen, when occurring in a child; though in an adult it might be due to osteitis deformans; and it is quite possible that the disease may be hereditary syphilis in the third generation.

There are some points of interest in regard to the pain. The pains are not only osteocopic, occurring at night, but are also brought on by fatigue. In one of the cases reported, they came on about four o'clock in the afternoon. I think that the pains in these cases are of the nature of those which Ollier has described particularly, and which are often spoken of as "growing-pains." They are pains of adolescence, depending on temporary or permanent hyperæmia of the bones. We have from any cause—here as a result of the inherited syphilitic taint—a condition of subacute osteitis; by exercise of the limb the hyperæmia of the bone is increased, and, as a consequence, we observe the pains coming on toward evening. That is Ollier's explanation of the so-called growing-pains of children, due to a condition of hyperæmia of the bones connected with their rapid growth in early life.

The deformity in these cases is due not only to the thickening of the bone, but also to the fact that the disease causes softening, and that then the action of the muscles, particularly the gastrocnemius and soleus, causes anterior bowing just as we see it in cases of rhachitis. I do not think that Dr. Davis is quite correct in saying that the elongation of the bone is not due to growth from the epiphyses. I believe that it is due to irritation transmitted to those parts. Even if the lesion is in the shaft of the bone, the irritation transmitted to the epiphyses will cause an increase in length, while the growth in thickness is from the periosteum. This matter has been thoroughly worked out by Ollier by experiments on animals, and I think that it may now be regarded as a surgical axiom.

Dr. T. S. K. Morton: Had I known the nature of the cases which were to be presented here to-night, I should have brought another case in which the lesions are even more marked than in those shown by Dr. Davis. This case was referred to me some two months ago by Dr. M. T. Prendergast, and occurred in a child six years of age. There was no history of syphilis. One year previous the child had a typical attack of typhoid fever. This ran the usual course, and three months after recovery from it a nodule appeared on one of the tibiæ; the tibiæ of both legs enlarged. Subsequently a nodule appeared on one ulna and then on the other. When I saw the case the entire front portions of both tibiæ were tremendously enlarged. Both ulnæ were enlarged, particularly at the upper third. At the lower end of the right ulna there was a great knob of bone. This was as large as a hen's egg. The olecranon process had a similar knob, although larger. The case had been treated with anti-specific remedies without effect, but with the production of the toxic effect of the drugs used. The pain was considerable. The tibia had been very tender, but this had disappeared as time went on. It seemed that after the lesions reached a certain stage the pain disappeared. When I saw the case the ulnæ were in an active process of inflammation and were tender to pressure. The periosteum seemed to be involved, and there appeared to be a form of periostitis stimulating an immense growth of the bone beneath it. With the case Dr. Prendergast sent me a clipping from a French journal in which a number of cases closely corresponding to this one were reported as following typhoid fever and in which syphilis had apparently been excluded. This article also suggested the theory of periosteal stimulation in spots as a sequel of typhoid fever. As antisyphilitic remedies had been thoroughly tried, I resorted in this case to the use of the syrup of hydriodic acid, and applied to the more active lesions a twenty per cent. mixture of ichthyol in lanolin. The effect of this treatment was to lessen the periosteal irritation in the ulnæ. It had no effect upon the tibiæ, which seemed to have stopped enlarging.

CASE OF DERMATITIS VESICULOSA NEURO-TRAUMATICA OF FOREARM.

By LOUIS A. DUHRING, M.D.,
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[Read December 2, 1891.]

A. A., is a single woman, aged twenty-nine years, of small statnre, frail and spare. There is a history of varied nervous symptoms extending over the past three years, including freqnent and protracted gagging and vomiting attacks; complete cessation of the menstrual flow two years ago, which condition still exists; heart palpitation; crying spells; and globns hystericns. She was burned with a flat-iron eighteen months ago on the flexor surface of the left forearm just above the wrist, the area being about the size of a silver dollar. The burn was superficial and only slightly blistered, and at first presented no peculiarities. It did not, however, heal readily or entirely, and from some unknown and internal eause began to break ont anew, and within a month from the accident showed a superficial gangrenous patch, confined to the region of the burn, which remained about six weeks. The patch now began to be more inflamed and painful, with at first darting, then aching pains, which continned in about the same severity for two months. The whole forearm at the date of the gangrenous patch was reddened, swollen, and tender, and was accompanied with throbbing pain, which could be distinguished from the darting pain.

The present form of eruption first appeared about the time the burn seemed to be nearly healed, or a month or six weeks after the accident, in the form of a single papulo-vesicle, or a "pimple," and this not at the site of the burn, but on the extensor surface of the forearm. In a week or two this lesion ulcerated and crusted, and other similar papulo-vesicles, vesicles and blebs appeared beside or near this one, until the present area of disease was ultimately attained. Some healed while new ones formed, most of them leaving scars as they passed away. Various forms of local treatment were employed, none of which seemed to possess power to arrest the process, nor indeed to favorably influence the ernption. Arsenic was on several occasions prescribed, but had to be discontinued on account of intolerance of the drug. Reference has been made to the swollen and painful condition

of the whole arm at times; this has occurred frequently—every few weeks or even oftener—and is invariably aggravated by exertion or any exercise of the limb. After these attacks of general pain and swelling, the whole limb is sore to contact, and is painful within. The pain, both darting and aching, is most severe in damp or cold weather.

When I saw the case first in January, 1891, the lower half of the forearm was involved and was encircled by the disease, and more especially the extensor surface; the burn, it will be remembered, having been seated on the flexor surface. The disease consisted of a small, hand-sized, irregularly-shaped, ill-defined, chronically inflamed, vesicular and bullous, herpetic-looking, more or lest crusted, scarred patch, with scars considerably beyond the inflamed skin. Apart from the old scars, it possessed at first sight the general appearance of an injury due rather to the local action of an acid or to some chemical substance than to disease from within. There was, moreover, some oozing and discharge from broken or ruptured vesicles, blebs, and excoriated surfaces. The inflammatory process of the skin was superficial, for there was but little thickening, and the scars were not deep. The vesicular and bullous lesions were irregular in outline, more or less angular; distended, but with no disposition to rupture; some flat, others raised, and usually were unaccompanied by areolæ. They possessed an herpetic aspect, and from this characteristic formation were manifestly due to direct nerve influence. The crusts were depressed, saucer-shaped, and adherent to the skin in the centre, with everted edges. They were variegated in color, with bluish and blackish tints. The scars were plainly the result of the vesicular and bullous lesions. The patch was irritable, sore to the touch, and painful, and the whole extremity up to the shoulder was likewise the seat of darting nerve pain.

The process has continued in much the same manner up to the present date, although the pain in the patch and the nerve pain in the limb are not so severe as last winter, nor is the inflammation of the skin so violent now as formerly. With the view of stimulating the nerve-trunks and fibres into healthy action, I advised the use of a weak galvanic current. This has been applied for a month, but no positive results have been obtained. Before abandoning the remedy, however, it is proposed not only to stimulate more freely, but also to act upon the nerve-trunks at remote points above the seat of the disorder.

Concerning the pathology of the disease, it may be stated that I believe the process to be a mild form of neuritis of a peculiar kind, having its origin in the burn, from which it extended, involving collateral as well as the nerve-trunks. It appears to be a local disease, that is, to be confined to the limb. The hysteria must, of course, be taken into consideration. It is questionable, however,

whether the symptoms can be construed as indicative of a central or a reflex origin. The latter explanation has been suggested by Kaposi, Doutrelepont, and others for a series of similar though not identical cases, occurring for the most part in hysterical women, to which further reference will be made. The possibly factitious nature of the disease need not be entertained. The question of infection may be alluded to, but there does not seem to be any symptom pointing that way. The case is a rare one, although I am aware that more or less similar forms of disease have been recorded. With the title "Traumatic Neurosal Pemphigus," Dr. J. H. Galton, of England, has recently reported a case similar to the one just considered (*British Medical Journal*, June 13, 1891).

The patient was a well-nourished, intelligent girl, aged seventeen, who had suffered from fits of an epileptic nature from childhood. In December, 1887, while cutting wood, she chopped off the distal phalanges of the index and ring fingers and cut through the middle phalanx of the middle finger. The wounds did not heal readily, but remained open for three months. Shortly afterward patches of redness, followed by blebs, appeared on the left wrist, hand, and arm. The eruption was peculiar from the rapid way in which it spread; sometimes in a quarter of an hour the whole hand and arm would be covered with large blebs, which would burst, and give out a thin, sticky, watery discharge, which on drying would leave the surface of the skin of a purple or bluish tint. The circulation also seemed feeble.

In February, 1889, she had a crop of these on the left leg. Up to that time she was rarely without a series of blebs or threatening of them for quite twelve months. Various remedies, including arsenic and iron, were tried without effect. At this time the puckered scars of the ring and middle fingers were very tender, and the stumps were amputated.

In March, 1889, she had a much slighter return of vesicles, and since, for the next two years, only occasionally a few vesicles. At one period a small fragment of bone worked out of the dorsal surface of the wrist. The vesicles occurred in irregular patches upon both surfaces of the forearm in the area of the median and ulnar nerves.

Dr. Galton considers that the irritation was reflex because of the disseminated distribution of its effects and the occurrence of the disease on the leg of the same side, as well as its cessation after removal of a source of irritation upon the median nerve alone.

Erasmus Wilson[1] refers briefly to the case of a medical man

[1] Diseases of the Skin, p. 307. London, 1867.

who punctured his right hand. Three or four weeks afterward an eruption of blebs made its appearance on the left thigh, and was repeated from time to time for eighteen months. Their outbreak was preceded by feverish symptoms; there was a scalded sensation in the skin, and the next morning a fully developed bulla would be discovered.

A similar form of disease has recently been narrated by Ehrmann,[1] that of a pemphigoid eruption, having its seat upon the district of the trigeminus, and due to a carious tooth, which later appeared on the other side of the face. The eruption recurred from time to time, and remained unilateral until the removal of the tooth, when it manifested itself on the other side.

Prof. Kaposi, of Vienna, with the title "Pemphigus Neurotico-traumaticus (Hystericus)"[2] reports the case of a female nurse, aged twenty-two years, who had wounded the nail-fold with a rusty nail, the wound having been dressed with iodoform. In a few days blebs appeared on the dorsal surface of the middle finger, and a few days later on the dorsum of the hand and wrist. When she first came under observation, four weeks after the accident, there was a reddened, painful patch, about the size of the palm of the hand, covered with large blebs. Immediately afterward blebs began to appear in other localities, being always preceded by pain in the affected part, followed in two or three hours by bright redness over a variably sized area, upon which urticarial lesions formed, succeeded in a few hours by blebs, from the size of a pea to that of an egg. With each attack the cutaneous involvement became more general. Kaposi regards the disease as a neuritis following a wound, notwithstanding that the further course of the affection was not on the track of the wounded nerve. From the peripheral excitation the process, he thinks, passed over to the central nervous system, more especially to the vasomotor system.

Dr. D. W. Montgomery,[3] of San Francisco, relates the history of a medical student, of a neurotic temperament, who received a blow on the index finger of the left hand, causing a wound which

[1] Archiv für Derm. u. Syph.; 1890, p. 954.
[2] Wiener klin. Wochenschr., No. 22, 1890.
[3] Occidental Medical Times, October, 1891.

was slow to heal, almost necessitating amputation. Three years afterward, and during the following three years, a pemphigoid eruption invaded the skin and mucous membranes of different regions, which both Dr. Montgomery and Dr. Regensburger, who also had the patient under observation, regarded as due to the previous traumatism, notwithstanding the long period elapsing between the wound and the cutaneous manifestation.

Similar to this is the case narrated by Kopp,[1] of Munich, in which, five years before the cutaneous manifestation, the patient was burned on the left hand. The wound inclined to ulcerate, but finally healed with keloidal scars.

Routier,[2] of Paris, gives the history of a young girl who was affected by panaritium, which was followed by numerous gangrenous patches on the skin of the same hand and forearm, which subsequently spread over the upper portion of the thorax. This observer is inclined to regard the disease as due to a general neurosis.

Prof. Doutrelepont,[3] of Bonn, under the title "Acute Multiple Gangrene," reports the case of a female nurse, twenty-one years of age, who stuck herself with a needle under the left thumb-nail. The disease at first was confined to the left upper extremity, but it soon became bilateral, and during the succeeding five years, until the date of her death, every region of the skin, and also the mucous membrane of the upper air-passages, the conjunctivæ, and the vagina, became invaded. Bronchitis, catarrhal pneumonia, and tuberculosis, with a fatal issue, followed. In the beginning all the lesions were gangrenous, but subsequently vesicles and blebs occurred on the gangrenous patches. Doutrelepont[4] (after an interval of four years) has recently given the sequel of this case, and, in the light of Kaposi's series of cases (to be referred to presently), is inclined to look upon it as a universal herpes zoster gangrænosus. Kopp now also takes the same view of his case, to which I have briefly referred.

[1] Münchener med. Wochenschr., 1886, No. 38.

[2] La Semaine Médicale, 1888, pp. 416 and 428.

[3] Archiv für Derm. und Syph., 1886, p. 179; and ibid., 1890, p. 385.

[4] Archiv für Derm. und Syph., 1890, p. 385.

As allied to this group of cases, I may refer to those examples of so-called gangrenous herpes zoster reported by Kaposi, to which allusion has been made, and also to those cases designated by authors as "spontaneous gangrene" and "hysterical spontaneous gangrene." Kaposi[1] has recently reported four of these peculiar cases, to which he gave the name "zoster gangraenosus recidivus atypicus hystericus." These titles sufficiently designate the characteristics of the eruption, but the manner in which they are produced, whether reflexly from the brain or through the vasomotor system, is not clear. Kaposi is of the opinion that they arise from an hysterical basis, and are vasomotor or tropho-neurotic, and may be explained by the irritation going from the peripheral nerves directly through the cutaneous vasomotor centres, or reflexly, meeting in the cord or brain, and calling forth the symptoms.

I have thus brought forward a case which at first seemed obscure in its nature and difficult to classify. Upon looking into the subject we find, however, that more or less similar cases are on record, reported by several well-known observers. Notwithstanding the presence of hysteria, an explanation of the symptoms—nervous and cutaneous—may be found, I believe, by regarding the process as a traumatic ascending multiple neuritis

In all the cases to which reference has been made, there exists a positive neurotic pathology, which, however, differs somewhat in certain particulars. The most interesting point is whether they are reflex in their nature. This view, as we have seen, is held by several distinguished observers, and the explanation touches upon an almost untrodden, but important, field in cutaneous pathology. In the case which I have described, however, there does not seem to be sufficient ground for regarding the affection as reflex, the symptoms being explicable by local pathology, but I can well understand this to be the proper explanation for some of the other cases to which attention has been directed.

[1] Archiv für Derm. und Syph., 1889, p. 561.

DISCUSSION.

Dr. Clark, of Orange: When this patient first came to me there was a spot about the size of a silver half-dollar, the surface of which was black and dry, with very little secretion. I applied a carbolated zinc dressing. A line of demarcation soon formed, and as the slough separated I cut it away. This seemed to involve the entire thickness of the skin. The ulcer was healing under aristol ointment, but had not completely healed when the first blebs made their appearance near the margin of the scar. I resorted to tonic treatment by means of Donovan's solution with no benefit. At times the eruption would nearly heal, and then fresh blebs would form and break, leaving an ulcerated surface. After the original ulcer had thoroughly healed the scar had much the appearance of a keloid. Finding that there was no marked improvement, I sent her to Dr. Duhring.

Dr. John K. Mitchell: I see no evidence of neuritis in this case other than the eruption. There is no smoothness or glossiness of the skin such as we see in chronic neuritis, and no difference in the skin and nails of the two hands. Nor is there any sign of chronic neuritis in the way of pain. The distribution is not like that of a neuritis. If it is from a neuritis, why should it surround the whole arm? Taking these points into consideration, the case does not seem to me to be like one of neuritic origin.

Dr. Duhring: The chief interest in the case lies in its pathology. In studying most of the similar cases, reported under the head of spontaneous gangrene and hysterical gangrene, two theories present themselves: Are the symptoms the result of a local neuritis passing up through the nerves, or are they the result of reflex action, the irritation travelling up to the nervous centres, and being then reflected? Some eminent observers in reporting cases of this kind take the ground that they are reflex. While this may apply to many cases, it does not, I think, apply to the one just reported. The manifestations here may be explained by local pathology.

UNUNITED FRACTURES.

By OSCAR H. ALLIS, M.D.,
SURGEON TO THE PRESBYTERIAN HOSPITAL, PHILADELPHIA.

[Read December 2, 1891.]

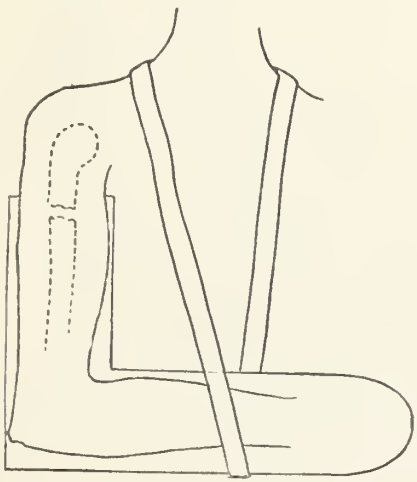
For knowledge concerning the frequency of non-union in fractures we turn naturally to hospital statistics, and are astonished to find no recorded case. This would imply that hospital surgeons were loth to put on record their failures, or that hospital treatment was superior to that in private practice; but neither conclusion is correct. Hospital records recognize but three classes, viz., "cured," "relieved," and "died." Now, few cases of simple fracture require more than two months, and were a case to be dismissed at the end of three or even four months, it would neither be true as a matter of fact, nor just to the surgeon treating the case, to place it on record as a case of "non-union." I have made no attempt to collect cases, but can recall eighteen cases—eight of the humerus, five of the femur, two of both bones of the leg, two of both bones of the forearm, and one of the jaw. These cases were treated in the Pennsylvania, Presbyterian, St. Mary's, Jefferson, and Hahnemann Hospitals, and in private practice. I have no means of estimating the frequency of non-union, but feel that the estimate of Hamilton (1 : 500) is much too low.

The most extensive statistical tables with which I am acquainted (Agnew's) give much interesting material, from which I formulate the following: That fractures in long bones occur most frequently near the foot and wrist, while non-union occurs most frequently

near the shoulder and pelvis. In other words, the further from the trunk, the more frequent the fracture; the nearer the trunk, the more frequent non-union. If syphilis, scurvy, old age, wasting disease, paralysis, fevers, etc., were the cause of non-union, then it would occur most frequent in the parts in which fracture was most frequent, but this is not the case. Fracture in the long bones occurs more commonly in the leg above the ankle, but non-union is more than twice as common in the humerus near the shoulder.

Surgeons at the present day believe that non-union is chiefly the result of faulty fixation, as a result of which the reparative process

Fig. 1.

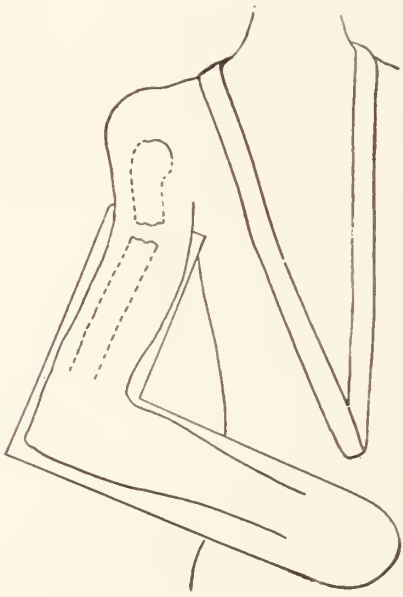


is disturbed. This disturbance is from uncontrolled or uncontrollable muscular action: the latter when the patient is suffering from delirium; the former when the patient is conscious, but, either through neglect or over-anxiety to help himself, resorts to harmful muscular activity.

To secure the most perfect fixation, the profession resorts to splints, and sometimes the object of fixation is defeated by the very means adopted to secure it. This is illustrated in the case of the long rectangular splint used by many practitioners in all fractures

of the humerus. A glance at Fig. 1 will show that the upper fragment receives no support from the splint, while, when the hand is removed from the sling (as it invariably is as soon as the soreness leaves the part), the long splint will itself compel the fragments to separate as in Fig. 2. In such a case my practice has been to place thorax, shoulder, arm, and forearm in a plaster-of-Paris splint.

Fig. 2.



When suffering from fracture in the upper third of the humerus shall the patient be permitted to rise and go about? If we ask those in whom non-union resulted, they will tell us that attempts to rise in bed always caused the fragments to move. Whether or not I have seen an unusually large number of ununited fractures I cannot say, but the operation for their relief is so formidable, and the entire loss of time so great, that I now insist on recumbency in many cases that I would formerly have permitted to rise. It was a remark of my gifted colleague, Dr. Richard J. Levis, that there

was as good reason why a man should go to bed for a fractured clavicle as for a fractured femur. Certainly the bed is the place for the most perfect rest, and under no circumstances is rest more desirable than when nature is repairing a fracture.

I have stated that insecurity of fragments is the chief cause of non-union. Authors speak of the interposition of muscular tissue as a possible cause. If this is slight, the repair is not affected; but if the two fragments are widely separated, when fragments transfix

Fig. 3.

muscular fibre, or when in the leg or forearm a considerable fragment is lost from one bone only—under these circumstances non-union may take place. I was taught a useful lesson in one of my cases:[1] After cutting down upon the fractured parts, I found the fragments widely separated, and the fractured surfaces facing in opposite directions (Fig. 3). They had made a half-revolution upon each other, and were as distinct as if they had been in separate individuals. An interesting feature was the peculiarity of the healing over of the ends of the fragments. They each resembled the stump after amputation. In amputations Nature seems conscious

[1] Case treated in the coal regions and sent to Jefferson Medical College Hospital with non-union.

of having no splinting to do, and hence we see no circumferential bone-proliferation, no temporary core, but instead a healing over with compact tissue. In my case Nature seemed to recognize that an attempt at union would have been useless, and therefore made no effort.

Surgical Methods to Secure Bony Repair.—These are: (1) to stimulate reparative action without penetrating the seat of fracture; (2) to stimulate reparative action by means of irritants carried to the seat of the injury; (3) to boldly expose the fragments and reunite them by means of artificial agents.

I shall confine my remarks to the last head.

FIG. 4.

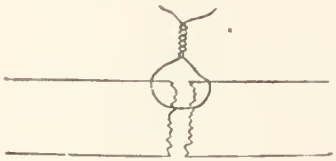
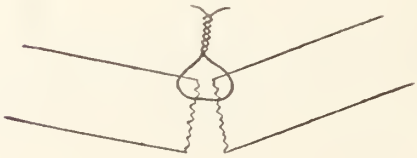


FIG. 5.

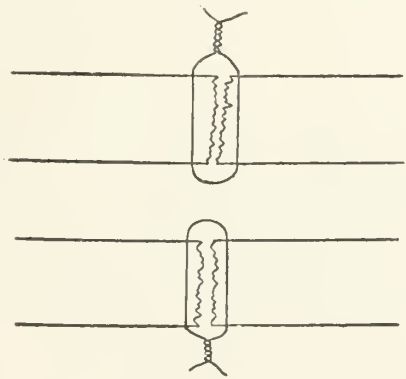


Operations that expose the fractured surfaces vary in degree. The simplest method of uniting the bones is by means of wire. A small awl or small chisel is usually carried to the seat of injury, and the ends of the bone thoroughly scarified; a wire is then introduced as represented in Fig. 4. In cases so treated the fragments sometimes unite firmly, but it is not because the wire plays any part in fixation (Fig. 5.) It is rather that the wire by its presence keeps up the inflammatory process so necessary to adequate bone-produc-

tion. Such cases get well on the principle of the seton, not by the law of fixation by wiring.

The wires are best used in non-union of bones of the forearm and leg. In the arm and thigh, in which we have but single bones, the wire is of little value as a means of fixation. When wires are used to fix the bones of the forearm, the best results are obtained when the wires pass entirely through each fragment (Fig. 6). Under these circumstances the bones are so securely fixed that union is almost certain to follow. In such operations it is well to approach

Fig. 6.

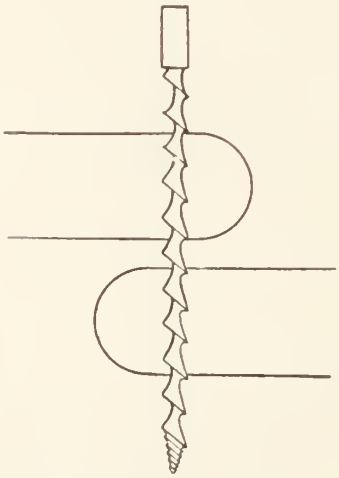


the radius and ulna by separate incisions, and thus avoid communication between them. By this means bridges between the radius and ulna may be avoided, and function restored with pronation and supination. The wires may be retained for two months. I use copper wire—a single strand, soft, pliable, but strong enough to hold the fragments.

I have never employed pegging by means of ivory or bone pegs. Theoretically it is a captivating thought to peg fragments with a material that will be absorbed—to close the wound and secure union by first intention. Practically the pegs act as foreign elements, and are not absorbed; suppuration takes place; fixation is not satisfactory; and if success follows, it is not due to the pegs.

As a means of fixation, nothing can compare in efficacy with the screw. In some form it has long been familiar to the profession. The elder Pancoast invented one that, from its size and character, was intended (1) to pierce the fragments without preliminary incision ; (2) to bind them together ; (3) by its presence to excite adequate inflammatory action. As the application of the screw was subcutaneous, it was uncertain in its action ; and, as there was a thread the whole length, the fragment could not be approximated after the screw had taken hold of both fragments. (See Fig. 7.)

Fig. 7.



I am familiar with its use in two cases : The first occurred when I was surgical interne at the Philadelphia Hospital. Dr. Maury employed it in non-union of the femur in the upper part of the middle third. The resulting inflammation was considerable, and before the screw was withdrawn repeated hemorrhages of a serious character took place. Bony union was finally established with about three inches of shortening, and the patient, a man in the prime of life, was restored to active manual labor. In the second case the elder Gross employed the screw in the case of a man, aged about forty-five, with non-union in the middle third of the humerus.

Union took place with almost complete paralysis of the forearm, probably due to injury of the musculo-spiral nerve.

Volkmann has called attention to the bridge-splice, a means of splicing long familiar to mechanics. The principle is sufficiently well illustrated in the accompanying figures, and needs no description. I have performed the operation twice, and in each instance secured

Fig. 8.

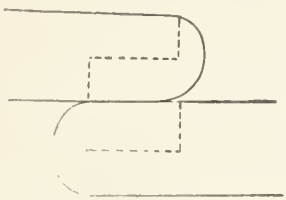
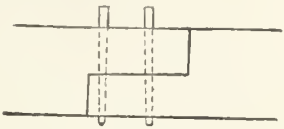
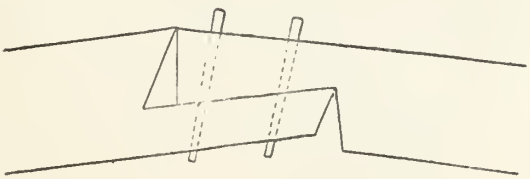


Fig. 9.



bony union; but I shall not employ it again, because the result as represented in Fig. 9 is unattainable. The carpenter, with rule, gauge, squares, mitre-boxes, and vice, may take two independent pieces of wood and so mortise them as to secure close joints and linear perfection, but the surgeon who makes three independent cuts in each fragment, held at best only in the grasp of an assistant

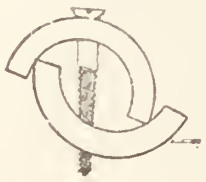
Fig. 10.



and shaking with each forward and backward motion of the saw, finds that he has no possible guide but his eye, and must not be surprised if his best effort more nearly resembles Fig. 10 than the one given by Volkmann (Fig. 9). In my second employment of the bridge-splice, I encountered a difficulty that gave me much uneasiness, though the result was satisfactory. In this case non-union in the lower third of the femur had resulted, and, after making the

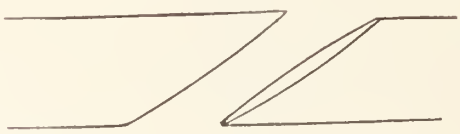
splice and inserting the screw, I was annoyed to have one fragment slip from its fellow, as shown in Fig. 11. This I could not prevent, but the final result was satisfactory.

Fig. 11.



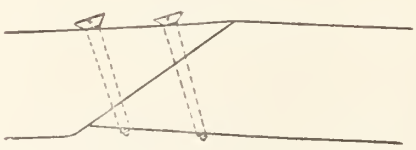
Since this mishap I have confined my efforts to the simple bevelled splice (Fig. 12) in single bones, *i. e.*, in humerus and femur. It gives the best surface-approximation; it exposes the least amount

Fig. 12.



of bone surface; it is more easily executed; and with it, when either one or two screws are used, the approximation is more satisfactory than can possibly be obtained with bridge-splice and pegs.

Fig. 13.



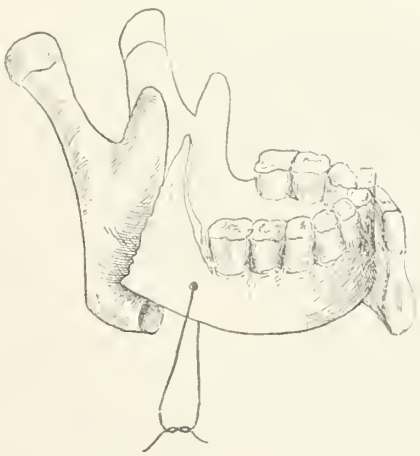
I have been using carpenter's screws for about four years. I was induced to adopt them from the fact that screws long enough to project from the wound, like those of Pancoast and Gaillard, were unnecessarily irritating. I select slim, steel screws sold at hardware shops, and am guided as to their length by the size of

the bone and the obliquity of the screw-holes. *The hole for the screw in the proximal fragment should be so large that the thread will not get a hold upon it. The screw-hole, however, in the distal fragment should be small, so that the screw will gain a firm hold.* With a screw-driver I then drive the screw down until the parts are firmly together—sometimes using two screws, sometimes one. I do not, as a rule, attach fine wires to the screws to enable me to find them. The screws are gradually forced from their beds by the reparative process, and can usually be picked from the surface of the bone after two months. I rarely need more than a pair of dressing forceps to effect removal. After the screw is removed, the sinus, which has persisted throughout the entire course of treatment, soon closes without any evidence of partial necrosis that would be supposed to follow the use of the screw.

The following case well illustrates the combined use of the screw and wire :

I. S., a colored man, came under my care four months after injury. He had been treated for fracture of the inferior maxilla to the left of the

FIG. 14.



symphysis, a fracture of the ascending ramus remaining undetected. When he came under my care the posterior line of fracture had united with considerable upward displacement, but there was no union at the symphysis.

In attempts to close the jaws a single tooth was all that could be utilized, owing to the elevation and overlapping of the fragments.

I operated by an incision exposing the line of union along the perpendicular ramus, and separated the fragments by means of a chisel. A strong wire was then passed through a hole made in the loose fragment (see Fig. 14), thus enabling my colleague, Dr. Hearn, to drag it into position. It was then secured to the perpendicular ramus by means of two screws. The

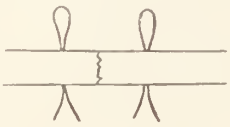


Fig. 15.

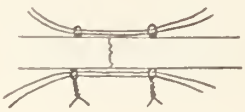


Fig. 16.

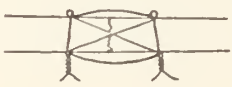


Fig. 17.

anterior fragments were then approximated and wired. Having bored holes through the jaw on each side of the line of fracture, I passed pieces of doubled wire through and made an eye of each, as in Fig. 15. Through these eyes or loops I passed a few short wires, and, drawing these tightly, I twisted them over other transverse wires (Fig. 16). I was then ready to secure the fragments, and, while these were forced into position, I took the free extremities of the wires and twisted them firmly. I thus secured the fragments, and the result was a useful, presentable jaw. Fig. 17 represents the concluding steps of the operation which, with modifications, I have repeatedly employed.

In all my operations, where free drainage has been maintained, I have had a minimum amount of inflammation. In one case abscesses formed in the surrounding connective tissue owing to failure to establish early, efficient, dependent drainage.

DISCUSSION.

Dr. John B. Roberts: I infer from what Dr. Allis has said that he keeps the wound open. I have had some experience with various methods of treating this condition, but it has not been very satisfactory, and my own feeling has been that in this particular class of cases immediate union by antiseptic and aseptic methods is a disadvantage. The bones have seemed not to unite so well as in the olden times, when we had a great deal of irritation from suppuration. I have been led to believe that in these cases it would be well to pack the wound with antiseptic gauze, and thus cause healing by granulation. When the wound is allowed to heal by first intention it seems that sufficient irritation is not produced.

Dr. Allis: I am obliged to Dr. Roberts for calling attention to this point. I dress these cases with the gauze or with a drainage-tube, leaving a sinus and never pretending to close the wound. There has in all cases been suppuration throughout the progress of the treatment. On the removal of the irritant—that is, the screw—the suppuration has ceased and no necrosis has occurred.

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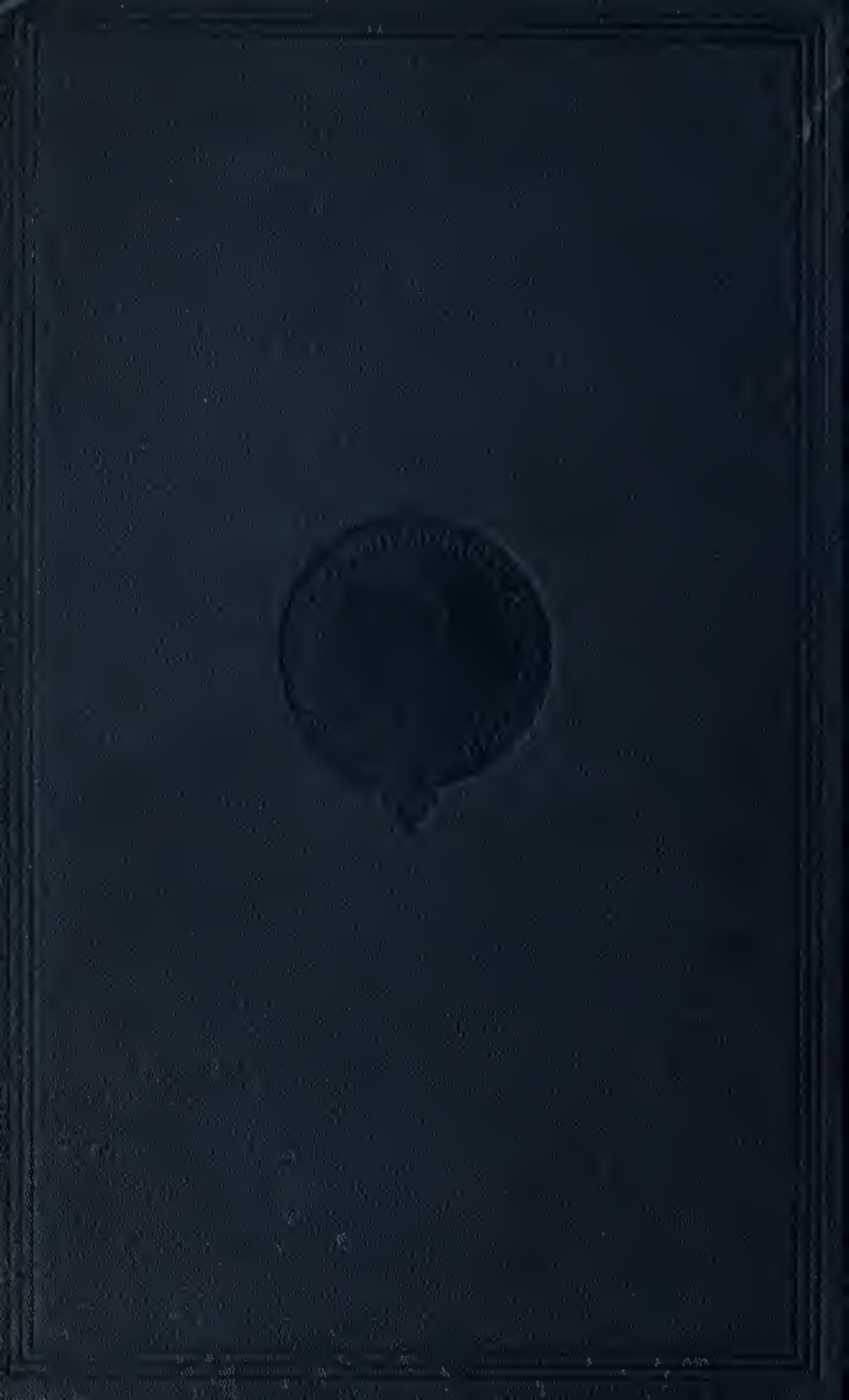
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